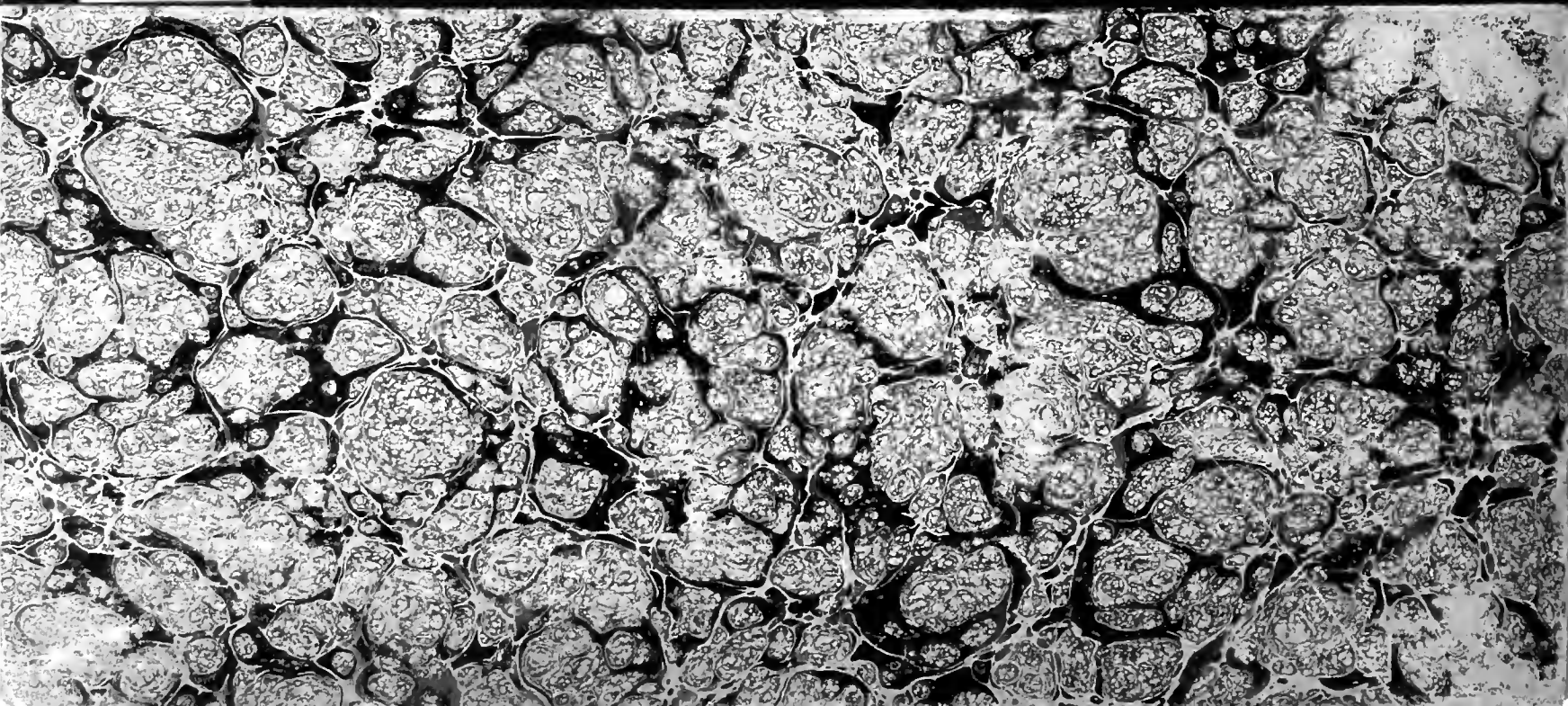
Insect Frequenting
the Cotton-Plant



34th Congress, 1st Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 12.

REPORT

OF THE

COMMISSIONER OF PATENTS

FOR THE YEAR 1855

AGRICULTURE.

WASHINGTON:
CORNELIUS WENDELL, PRINTER.
1856.

Statement of D. MINIS, *of Beaver Plain, Beaver county, Pennsylvania.*

Hogs are not much raised with us beyond the wants of the county, not being considered so profitable as other kinds of stock. The "China" breed is the most prevalent, though some keep the "Russian," the latter of which are not much esteemed on account of the cost of bringing them to maturity.

Pork is worth from 5 to 8 cents a pound; lard from 9 to 12½ cents.

Statement of ALBERT HOOPES, *of West Chester, Chester county, Pennsylvania.*

Hogs are raised here for home consumption, and a few for market. Several of the imported breeds have been tried, but all have given way to an "Improved Chester county" hog. Swine are generally kept in pastures during the summer, being allowed the slops from the kitchen, and the refuse milk from the dairy. When fattened with whole corn between the ages of six and eighteen months, they will gain about a pound a day.

The price of pork is from 9 to 10 cents a pound.

Statement of JAMES E. KENDALL, *of Poplar Grove, Kanawha county Virginia.*

Hogs are regarded as indispensable stock in this county. They grow large, and do well on acorns and beech mast. The only attention required is to keep them tame. A cross of the Berkshire and China breeds suits us best.

POULTRY AND EGGS.

CONDENSED CORRESPONDENCE.

Statement of GEORGE P. NORRIS, *of Newcastle, Newcastle county, Delaware.*

I have devoted much time to the poultry department of the farm; and, though at present the great mania for large fowls appears to have subsided, it cannot be said that our people have not been benefitted in having their attention called to the improvement of the various breeds.

The "Large Shanghai" fowls generally introduced throughout the country, are by no means the most profitable. They are regular, but not extraordinary layers, and grow very rapidly, but are enormous eaters. The principal benefit to be derived from them will be the cross obtained between them and the smaller breeds.

Of all the fancy fowls, I prefer either the "Black Spanish," or the "Polands." The former are handsome, of moderate size, hardy,

easily kept, and great layers, in consequence of which they have obtained the name of "everlasting layers."

The Poland fowls resemble the Spanish in everything except appearance. They are jet black, with a characteristic white top-knot, and are by many considered the handsomest variety known. Having had some experience with each breed, I can unhesitatingly recommend them, as they are well adapted to the wants of the farmers of the Middle States.

I should have mentioned, however, that none of the breeds noticed above are good sitters; therefore, a few hens of other breeds should be kept for the purpose of hatching the eggs of these, and rearing the young.

INSECTS.

INSECTS FREQUENTING THE COTTON-PLANT.

BY TOWNEND GLOVER.

The cotton-plant furnishes food for numerous insects, some of which feed exclusively upon the leaf, some upon the flower, while others destroy the young buds and bolls. It is my purpose to describe these insects, not in the order of their classification by natural families, but according to the part of the plant they most generally frequent, or to which their ravages are chiefly confined. Thus, by referring to the parts injured, one can easily recognise the insects, or their larvæ, which attack them in any of the stages of their existence.

Many of these insects at first appear in small numbers, and only become formidable in the second or third generation; for instance, if a female boll-worm produce 500 moths, one-half of which are males and the other half females, the next generation, if the increase be in the same ratio, will amount to 125,000 catterpillars or moths; and all this is accomplished in the space of a few weeks. It will therefore be perceived that their destruction depends upon prompt and timely action; and planters may materially aid in carrying out a work designed for their mutual benefit, by minutely observing the habits and characteristics of these pests of our fields, devising means for their destruction, and communicating the results of their observations and experiments, through some appropriate channels, to the public.

Insects injurious to the cotton-plant consist of those very destructive to the general crops, such as the boll-worm, cotton caterpillar, and some others; and those which do comparatively little injury, their numbers thus far not being sufficiently great to cause much damage, such as the leaf-rolling caterpillar (tortrix) and several

insects hereafter mentioned. There are still others, which do not materially injure the crop itself, such as the span-worm, and others which only feed upon the petals or pollen of the flowers. There are also many insects found in the cotton-fields which do no damage whatever to the plant, but merely feed upon weeds and grass growing between the rows, such as the caterpillar of the *Argynnis columbina*, which feeds upon the passion-vine, and that of the *Zanthidia niceppe*, which sometimes devours the Maryland cassia, and produces the beautiful orange-colored butterflies, seen in vast numbers hovering over moist or wet places on the plantations.

A class of insects which is highly beneficial, comprehends the larvæ of the lady-bird, the ichneumon flies, and many others, that are ever on the search for living victims amongst the noxious tribes, and which serve to keep the numbers of the latter within proper bounds.

Thus, it is highly necessary to be able to recognise the injurious from the comparatively innoxious as well as the useful insects, and I have therefore thought proper to describe and figure most of those which infest the cotton-fields, as many of them feed upon or injure the plants in one state or another; and, although they may do but little injury at first, yet, were they to multiply as fast as some others, they would eventually become as great a nuisance as the boll-worm is at present. According to a communication from Colonel Whitner, of Tallahassee, in Florida, the latter insect was scarcely known in that region before the year 1841; but it has since increased to such an extent as to cause an immense yearly loss to the planters.

Several methods of destroying insects on plantations and elsewhere have been recommended, one of which is the use of fire or burning torches. The innumerable myriads of nocturnal moths, being attracted by the lights, burn their wings as they hover around, and are either destroyed at once, or disabled from flying about to deposit their eggs in distant parts of the field. A species of lantern has been used for entrapping such as are attracted by light, and with some success. It is formed of a top, bottom, and back, made of wood, with a glass front and sides, a little more than a foot square, according to the size of the glasses used. The front is supported by a pillar at each corner; on the inside of the back of the lantern is fastened a tin or glass reflector. The three glazed sides consist of two panes, sliding in grooves, made in the top and bottom boards, and meeting in the middle at an angle of about 120°, instead of one pane, as in common lanterns. These panes can be slipped in and out, so as to leave a space open between them, larger or smaller as may be desired. A lamp is placed in the centre of the bottom, protected from insects and wind by a common glass chimney, which protrudes through a hole in the top. All the bottom of the box inside of the glass having been previously cut away, excepting a circular place on which to put the lamp, it is then deposited on a vessel or barrel covered with cloth, having an aperture cut in it corresponding with the bottom of the box, and the vessel beneath, containing molasses, or some other adhesive substance. The insects which may be flying about will be immediately attracted by the light, and approach the angle of the panes until they shall have entered the aperture, when, once within,

and not being able to fly out again, they will come in contact with the heated glass chimney, and thus be precipitated into the vessel beneath, in which they will perish.

Another plan, which it is hoped may, upon experiment, be found applicable to the enemies of the cotton-plant, has lately been reported as having proved efficient as a means of destroying the tobacco-worm, in Florida. This worm is the larva of a large moth commonly known by the name of the "tobacco-fly," (*Sphynx carolina,*) which is in the habit of feeding upon the nectar, or honey, contained in flowers, over which it may often be seen in the evening, poised in the air in a manner similar to that of the humming bird, making a buzzing noise with its wings, and busily employed in extracting the sweets by means of its long trunk.

As it had been previously observed that these moths are particularly fond of the Jamestown weed, (*Datura stramonium,*) a plan adopted in Florida as an effectual means of destroying them, and which it is said has succeeded to a considerable extent, has been communicated to this Office by Mr. Jesse Wood, of Mount Pleasant, in that State, who says:—

"About five years ago, Mr. Igdaliah Wood, of this vicinity, endeavored to poison the fly that produces the horn-worm, by applying a preparation of cobalt and sweetened water to the flower of the tobacco-plant. He found some difficulty in consequence of the cup of this flower not being in a favorable position to retain the poison. Mr. George Sunday next tried the bloom of the gourd-vine with better success. Mr. E. Johnson afterwards used the Jamestown weed, which answered the expectation of the most sanguine. The preparation consists of about a pint of water, a gill of molasses or honey, and an ounce of cobalt. After inserting a quill through the cork of the bottle, he let fall a few drops of this mixture into the cup of the flower about sunset. As this poison will soon kill the stalk of the Jamestown weed, the best plan is to break off the blossoms, make a hole in the ground, and place them in it. It is thought that the flies find them quicker than when left upon the stalks. It is certain to destroy the moths, although they frequently live until ten o'clock the next day, notwithstanding they are disabled from flying or depositing their eggs soon after taking the poison.

"I consider this discovery of immense value to tobacco planters, and, if it or any similar method should lead to the destruction of the cotton caterpillar and boll-worm, which is highly probable would be the case, it will be of incalculable benefit."

From this statement, it will be seen that, if such a plan is really of utility when applied to the cotton-fly, there can be no reason why it should not answer also in regions where honey-bees are not kept, for all such insects as are attracted by sweet substances; and it is to be hoped that experiments will be made the ensuing season, and reported for the public good. The thing to be chiefly desired now is, to find out the favorite food of the particular kind of insect to be destroyed; then to discover and use some efficient poison for the accomplishment of the purpose. If, however, birds should perish

from feeding upon these poisoned insects, it will somewhat militate against the advantages of the plan.

Several experiments were made in Florida by the writer, on the utility of using arsenic, cobalt, and strychnine, as means of destroying insects, some few of which succeeded, while many failed. In several instances, the insects would not touch the mixture at all.

Honey or sugar and rum, when rubbed on the bark of trees, will attract and intoxicate several species of insects, and might sometimes be advantageously used. Many planters in the Southern States recommend the berries of the "China-tree," or "Pride of China," (*Melia azederach*,) to be put around cabbage-plants, in order to prevent the attack of the cut-worm; and, as it is already known that these berries have an intoxicating effect upon the robins which eat so freely of them, they may have the same narcotic properties when applied to insects. It is at least worth while to make the experiment. Whale-oil soap, mixed with water, in proper proportions, thrown upon plants infested with plant-lice (aphides) is almost certain to destroy them. Flour of sulphur is stated to be useful when applied to grape-vines, or any other plants which are infested with the red spider or are attacked by a fungoid growth. A mixture of a gallon of water, a gallon of whiskey or other spirit, and four ounces of aloes, was highly recommended in Florida as a certain remedy against the attacks of the orange scale insects; but, with some who have tried it, although all the insects appeared to be destroyed, in a few weeks they reappeared, showing that the wash would have to be continually repeated until all the eggs under the scales had hatched and the younger broods were killed. Perhaps the same mixture might be successfully used for several other kinds of insects.

But, while so many artificial modes are recommended to accomplish the destruction of insects, planters are very apt to overlook the great daily benefits derived from other agents which have been kindly provided by Nature to check their undue increase. These agents are the birds, which constantly destroy them in any of their varied forms, larva, pupa or perfect insect. Mocking-birds and bee-martins catch and destroy the boll-worm moth, and many others, even on the wing, when the latter first appear upon the plantations, and thus materially diminish their numbers. If the fields are ploughed in the fall, many insects and chrysalides, which would otherwise come out in safety in the spring, are turned to the top of the furrow-slice, and either fall a prey to the ever-busy birds, or perish from exposure to the wintry frosts.

The nimble and graceful lizards of the South also act beneficially to the planter, as they are constantly on the alert, and catching every insect that chances to alight in their way. Toads, also, do much good, as they wander principally during the morning and evening hours, as well as in cloudy weather, and entrap insects by means of their viscid tongues. Such benefactors as these should be preserved, and not injured or killed as they often are. One pair of wrens or blue-birds, in a Northern garden, or of mocking-birds, on a Southern plantation, will accomplish more in destroying insects injurious to vegetation than can be imagined by one who has not studied their

habits, or watched them with attention, when busily engaged in searching under every leaf, or in every fissure of the bark, for their insect prey.

INSECTS FOUND UPON THE STALK.

THE CUT-WORM.

I have not been able this year (1855) to procure specimens of the worms which cut off the young plants early in the season, (Pl. VI., fig. 1,) as I arrived in the region of cotton-fields after their ravages had ceased; but, from the authority of able and scientific planters, I am induced to believe that they are very similar in habits and appearance to many of the cut-worms of the gardens, which penetrate the earth close to a plant, and at night emerge from their retreats to gnaw it off at or near the ground.

A gentleman in Florida, who had been troubled with this pest, informed me that a particular spot of four or five acres in his field had been literally thronging with cut-worms, so that most of the plants were either eaten off or destroyed, and that, finally, fearing the loss of his whole crop, he turned into the enclosure some twenty or thirty young pigs, which soon discovered the worms, rooted them up in great numbers, and fattened on the unaccustomed diet. The cotton was not injured, as the pigs were too young to root deep enough to destroy the plants. The pigs remained where the worms were to be found, never troubling any other portions of the field, and their strong powers of scent enabled them to detect their insect prey even when buried in the earth.

Should the moths of this cut-worm be like those of their congeners of the North, and attracted by light, it might be well to use a lantern like that already described, or to ascertain the favorite substance upon which they feed, and poison them, as suggested in the case of the tobacco-fly.

INSECTS FOUND ON THE LEAF

THE COTTON-LOUSE.

(*Aphis?*)

When the cotton-plant is very young and tender, it is particularly subject to the attacks of the cotton-louse, (Pl. VI. fig. 2,) which, by means of its piercer, penetrates the outer coating, or parenchyma of the leaf or tender shoots, and sucks the sap from the wound. The under part of the leaves or young shoots are the places mostly selected, and the constant punctures and consequent drainage of sap enfeebles

the plant and causes the leaf to curl up, turn yellew, and subsequently fall to the ground. The young lice are extremely minute, and of a greenish color; but when they become older, they are about a tenth of an inch in length, and often dark green; but, in some instances they are almost black. It is conjectured that the color somewhat depends upon the health of the plant as well as that of the insect, or perhaps, upon their food, as I have seen green and black lice promiscuously feeding upon the same plant. The female produces her young alive throughout the summer, when she may often be seen surrounded by her numerous progeny, sucking the juice from the leaves and still producing young. Some naturalists state that the females, late in the fall, produce eggs for the generation of the next spring. If so, it is in order to preserve the species, as the insects themselves are easily killed by frost and cold; and their increase would be incalculable were it not that Nature has provided many enemies among the insect tribes to prevent their too rapid multiplication. Both males and females are said to possess wings at certain seasons; but the females and young in summer appear to be wingless. The end of the abdomen of both sexes is provided with two slender tubes, rising like horns from the back, from which often exudes the "honey-dew," or sweet gummy substance, seen sticking to the upper sides of the leaves beneath them, and which forms the favorite food of myriads of ants. Although young plants are mostly attacked, yet I have seen old "stands" in Georgia, with their young shoots, completely covered with this pest as late as November.

The principal insects that destroy the aphides are the lady-bird, the lace-fly and the syrphus, all of which wage incessant war upon them, and devour all they can find. Another fly, the ichneumon, likewise lays an egg in the body of the louse, which, hatching into a grub, devours the inside of the still living insect until it eventually dies, clinging to the leaf even in death, and the fly makes its appearance from the old skin of the aphis.

When old cotton-plants are suffering from the attacks of the louse, many planters cause their tops to be cut off and burned, and by so doing partially succeed in destroying them; yet, when we consider that, by this method, many young blossoms and "forms" must likewise be destroyed, it must be confessed that the remedy is almost as bad as the disease. In a garden or green-house, a solution of whale-oil soap, from a syringe, showered upon the upper and under parts of the foliage, has been used with much advantage; yet, upon the extended scale of a cotton plantation, such a remedy is altogether impracticable, and, until we can collect further information upon this subject from intelligent planters, we must rest content with the instinct of our insect allies.

GRASSHOPPERS.

(*Locusta ?*)

Grasshoppers, or, more properly speaking, "locusts," occasionally do much damage to young cotton-plants, as they not only feed upon

the tender leaves; but have been caught in the very act of devouring the petals of the flowers in the fields of Georgia, as late as the month of November; but, as at this time the grass on which they usually feed abounds between the rows, the damage done by them to the general crop is but slight.

Several species of grasshoppers, or locusts, infest old cotton and grass-fields, some of them being of large size and possessing great powers of flight. (Pl. VI. fig. 3.) It may, however, be observed, that the true locust is not the insect generally known by that name in the United States, which is in reality a harvest-fly, (cicada,) usually inhabiting trees, where it makes an incessant buzzing noise which may be heard at a great distance during the summer and autumnal evenings. The shape of the harvest-fly is much clumsier and broader than that of the real locust, and the under wings are not folded up like a fan, under a wing-case, but transparent, stiff, and veined.

The real locust is similar to the grasshopper in shape, but the body is more robust, the antennæ shorter, and its flight much longer and more vigorous. Its under-wings, also, when at rest, are folded up in fan-like plaits under the outer wing-covers. Grasshoppers and locusts are produced from eggs as perfect insects, with legs and antennæ. They are able to run about and leap with great agility, but are entirely destitute of the rudiments of wings, except in the pupa state. It is only the perfect insects which are able to perpetuate their kind. They are generally furnished with ample wings which enable them to fly from field to field. Grasshoppers and locusts do much harm, when very numerous, to grass and vegetables, and even to fruit-trees, as well as to cotton. Turkeys, ducks, and other fowls feed upon them with great avidity, and are very useful in diminishing their numbers. In some of the Northern States, they have been destroyed by means of sheets spread upon poles, so as to sweep them into a bag fastened behind, which is drawn over the fields infested by them; they are then killed by means of boiling water or fire.

THE LEAF-HOPPER.

(*Tettigonia?*)

The leaves of the cotton-plant are often injured by the leaf-hopper. (Pl. VI. fig. 4.) This small insect is found upon the plant in the larva, pupa and perfect state. In all these forms, it sucks the sap from the leaf, causing small diseased and whitish-looking spots, much disfiguring the foliage, and injuring the plant itself, when the insects are very numerous. They are also found in great numbers on grape-vines, in Florida, and injure the foliage to a considerable degree.

The perfect insects are very small, measuring only from one-tenth to three-twentieths of an inch in length. The head is somewhat crescent-shaped, of a green color, with two red spots on the upper surface. The thorax is also green, with two crescent-shaped spots of red on each side of a small red spot in the centre. The wing-cases are green, with two stripes or bands of red, running parallel down each wing-

case, from the thorax to the upper margin, where they form an acute angle. The legs are yellowish-green, the hinder pair being much longer than the others, and furnished with bristles on the tibia. In the larva state, they are able to leap with great agility; but it is only in the perfect state that they are able to fly, the under-wings being hidden by the wing-cases, and not perfectly developed in the larvæ or pupæ. There are several species of these insects found upon cotton, which it will not be necessary here to describe, as their natural history and habits are nearly the same.

In using the lantern already described, it was found that thousands of these small insects were attracted from some grape-vines in an adjoining field. The use of fires or lights may therefore be recommended to destroy them, when they become very numerous, although, as regards the cotton, they are not often found on it in numbers sufficient to do much harm.

THE COTTON CATERPILLAR.

(*Noctua zylina.*)

The leaves of the plant are sometimes entirely devoured by what is commonly known to planters as the "cotton caterpillar," or "cotton army-worm." (Pl. VI. fig. 5.) It does not appear every year in immense numbers, but at uncertain intervals. This season, (1855,) it first made its appearance in the vicinity of Tallahassee about the month of August, on the plantation of Mr. Hunter, and then spread gradually through the rest of the plantations in that region. In October, it had already committed considerable ravages in several of the cotton-fields, not so severe, however, as had been anticipated, though the crops on several plantations were somewhat injured.

The perfect insect, or fly, when at rest, is of a triangular shape, the head forming one, and the extremities of the wings the other two angles. The color of the upper-wings is reddish-grey, a dark spot with a whitish centre appearing in the middle of each. The under-wings are of a dark reddish-grey. The moth of this caterpillar loses much of its greyish cast when it becomes older, and the down has been rubbed from the wings. It then assumes more of a reddish tinge.

The perfect flies, or moths, are easily attracted by lights, and may be found resting in the day-time on the walls or ceilings of rooms, attracted there, no doubt, by the candles or lamps on the evening before. If undisturbed, they will remain motionless during the day; but, as night approaches, they fly off with much vigor and strength. When in the open air, they may be found among and under the leaves of the cotton-plant, as well as those of the weeds which surround the plantation. The eggs are deposited principally on the under sides of the leaves, but often upon the outer calyx; and I have even found them, when very numerous, upon the stem itself.

Wherever these caterpillars were very abundant, I counted from ten to fifteen eggs on a single leaf, which are very small, and difficult to be distinguished from the leaves themselves, on account of their green color. In shape, the eggs are round and flat, and, when examined under a microscope, they appear regularly furrowed or ribbed. Their color, when freshly deposited, is of a beautiful semi-transparent sea-green. They are closely attached to the leaf on which they are laid. I am thus particular to state this, because, in an able article published some time ago, it was alleged that "the egg is fixed upon the leaf by a small filament attached by a glutinous substance." This mistake might the more easily be made by any person who had not himself observed the eggs when hatching, as that of the lace-wing fly is held by such a filament, and, moreover, is found in similar situations on the leaves, but generally with or near a colony of plant lice, where the instinct of the parent lace-wing fly teaches it to deposit its eggs, and thus provide for a supply of fresh food for the young larvæ, which feed upon and destroy millions of the cotton-lice. There is a great difference also between the eggs of the caterpillar moth and those of the boll-worm moth, the first being, as before stated, round and flattened in shape, and green in color, whereas those of the boll-worm moth are not flat, but more of an ovoid shape, and of a dirty-yellowish tinge. I cannot state exactly what time is required to hatch the eggs after they have been laid by the parent fly, as I could not succeed in procuring any from the moths hatched and kept in confinement, although carefully preserved for the purpose. Dr. Capers says that it requires from fourteen to twenty days; but the eggs I found in the fields invariably hatched within a week from the time they were brought into the house. However, this must depend a great deal upon the state of the atmosphere and the warmth of the season. The young caterpillars, when hatched, very soon commence feeding upon the parenchyma, or soft, fleshy part of the leaves, and continue to do so until they become sufficiently large, and strong enough to eat the leaf itself. They are able to suspend themselves by a silken thread when shaken from the plant. They change their skins several times before attaining their full growth, when they measure from one and a half to nearly two inches in length. The first brood of caterpillars, in August and September, were all of a green color, with narrow, longitudinal, light stripes along each side of their bodies, and two broader light-yellowish stripes along each side of their backs, down the centre of each of which was one distinct, narrow, light-colored line. Each of the broader bands was marked with two black spots on each segment; and on each segment of the sides were three or more dark dots. The head was yellowish-green, spotted with black. The caterpillars of the second and third generations are of a much darker color than those of the first; their under parts are more of a yellowish-green, and their sides sometimes of a purple cast; their backs are black, with three distinct light-colored lines running down their length; and their heads are also darker, and of a yellowish-brown, spotted with black.

The question naturally arises, What causes this change of color in the latter part of the season, since the moths hatched from the lightest

and darkest caterpillars prove to be exactly the same? Several planters attribute it to the influence of the sun, or to the food upon which they subsist; but this can scarcely be the case, as I have often observed individual caterpillars, evidently of the second or third generation, of the lightest green color, amongst a crowd of the black worms on the same leaf, as late as October, and exposed to the same influences of the sun.

These insects appear to multiply to the greatest extent in damp, cloudy weather. When the older caterpillars are suddenly touched, they have the habit of doubling themselves up and springing to a distance of several times their length, but when undisturbed, and not feeding, they appear to rest on the leaf with the fore part of the body elevated and somewhat curved, whereas, sometimes they keep up a species of swinging or jerking motion from side to side, as if enjoying the heat of the sun.

This caterpillar is furnished with six pectoral, eight ventral, and two anal feet, of which, however, the two anterior ventral ones are imperfect, small, and apparently useless, so that its mode of progression somewhat resembles that of the span-worm, or looper, of the North, elsewhere described.

In fifteen or twenty days after the caterpillar has attained its full size, it ceases to feed. It then doubles down the edge of a leaf, and fastens it with its own silk to the main part of the same leaf, or by webbing several leaves together, forming thereby a very loosely-spun cocoon. In this, it transforms into a chrysalis, which, at first is green, but in a short time after changes to a chestnut-brown, or even to almost black.

The first brood I raised, were fifteen days in the chrysalis state, before making their appearance as perfect moths; but, as this happened in a cold room and screened from the sun, I am of the opinion that, when they are exposed to a warm sun, in the open fields, the time must necessarily be much shorter. I raised one caterpillar late in the fall, which was even thirty days before emerging from its cocoon; but this I attributed entirely to the cold weather, and non-exposure to the sun. This fact would tend to show that the hatching of the chrysalis may be delayed, by peculiar circumstances, until long after the natural time.

The tail of the chrysalis is furnished with several small hooks, bent inward, by means of which it is enabled to hold fast to the loose web of which the cocoon is formed, while emerging from the chrysalis skin, or, in case of accident, to prevent it from falling out of the cocoon during the prevalence of strong winds.

There have been many speculations regarding the origin and periodical visits of this moth. In 1843, Mr. Whitemarsh B. Seabrook read a "Memoir on the Cotton-plant" before the State Agricultural Society in South Carolina, in which he says: "That the cotton-moth survives the winter is nearly certain; an examination of the neighboring woods, especially after a mild winter, has been often successfully made for that purpose. They were seen by the writer in May last, in the edge of a belt of pines, within a few yards of a cotton-field. In the winter of 1825, Benjamin Reynolds, of St. John's, Colle-

ton, found them in the woods, prineipally on the cedar-bush, eneased alive in their cover, impervious to water, and seeured to a twig by a thread. The pupæ, wrapped in eotton leaves, from their bleak exposure, invariably die on the approaeh of eold weather."

From what was stated to me by some of the best planters in Florida, last summer, it would seem that this eaterpillar appears on their plantations more or less, almost, if not every year, and sometimes in a most unaeeountable manner. Mr. E. Riehards, of Cedar Keys, furnishes a statement whieh would seem to prove that it is migratory in its habits, as there is no other method of aeeounting for its sudden presence, exeept that, having previously existed on some other plant, or weed, it had left it for food more eongenial to its taste, although it has been asserted that the real eaterpillar will eat nothing but eotton. He says: "The last of July, 1845, these eaterpillars made their appearanee in a small field of three or four aeres of Sea-Island eotton, planted on Way Key, as an experiment to see if cotton eould be advantageously eultivated on the Keys, no other eotton having been previously planted within 80 miles of them; but the whole erop was devoured. The eaterpillar was at the same time destroying the cotton in the interior of the eountry."

In a statement made this season by Mr. William Munroe, of Gadsden County, Florida, to the Agrieultural Department of the Patent Offiee, he appears to think Sea-Island eotton not so liable to be attaeked as the short-staple, when the two varieties are planted together. In his letter he says: "I observed, when I had two fields of eotton adjoining, the one short-staple and the other Sea-Island, and the eotton eaterpillars made their appearanee, that they always destroyed the short-staple eotton first. Four years ago, my erop was destroyed by the worm, and at that time they ate every green leaf on the short-staple eotton before they attaeked the Sea-Island. This year (1855) my short-staple erop was destroyed by the worm, on the Appalaehieola river, and I observed that after the short-staple crop was all eaten, several Sea-Island stalks in the field, at a little distanee, seemed to be uninjured; but, upon elose examination, it was found that the worm had just eommeneed upon them. My impression, from the above observation is, that, if we in this eountry were to eonfine ourselves to the produetion of the Sea-Island eotton, the attaek of the eaterpillar would be mueh less frequent, or would probably altogether eease."

In regard to the periodieal visitations of these eaterpillars, Dr. Capers remarks that their first appearanee, as destroyers of eotton, was in the year 1800, and that, in 1804, the erops were almost destroyed by them. A snow-storm oeeurred, however, and swept them away; but they were found the sueeeeding seasons, though in smaller numbers. In 1825, they were spreading, but perished again by a storm. In 1826, they destroyed the erops. The first notiee of them in this year was on the first of August, at St. Helena. Soon after, they were found on all the seaeoast, from New Orleans to North Carolina. On the 23d of the sane month, they had destroyed almost all the eotton leaves, but snddenly left the plant, though not for the purpose of webbing, as many of them were young. The cause of their sudden

disappearance is stated to have been that they were too much exposed to the powerful effects of the sun, in consequence of the plants being nearly destitute of foliage, and not protecting them from its direct rays.

Colonel Benjamin F. Whitner, of Tallahassee, has also written an interesting article on the depredations of this caterpillar in that vicinity. "In 1835," says he, "the crops were entirely exempt from the ravages of the caterpillar. In 1836, it appeared by the first of October, but did no harm. In 1837, no mention is made of it. These notes were made in Madison county, Florida."

Colonel Whitner then moved to Leon county, in the same State, where, in 1838, the caterpillar appeared early in August. The second brood stripped the plants by the 20th of September, and were so numerous that, after devouring the entire foliage, they barked the limbs and stalks, and ate out bolls nearly grown. In 1839, they were less numerous, and appeared late. In 1840, they came out from the 15th to the 20th of July, and, by the 6th of September, the plants were stripped of their leaves and young bolls, so that the entire crop was less than half of the average of other years. In 1841, this caterpillar was seen in Madison county from the 15th to the 20th of August, and in Leon county between the 20th of August and the 1st of September. The loss was serious, comprising probably one-fifth of the crop. In 1842, no damage was done. In 1843, they appeared near Tallahassee on the 1st of August, and plantations were stripped by the 15th of September. The crop was cut off from one-third to two-fifths by the caterpillar and storm. In 1844, the cotton-worm was found webbed up on the 13th of July, and by the 15th of September some plantations were entirely denuded; yet, in other parts of the county, the ravages were only partial. In 1845, there was no appearance of the caterpillar. In 1846, it was found webbed up by the 7th of July. The second brood began to web up on the 26th of that month; and by the 20th, the parts of the field in which the worm was first seen were found to be eaten out, and the fly, the worms, large and small, and the chrysalides, were discovered at the same time, a state of things never observed before. By the 5th of September, the damage amounted to a loss of more than one-half of the crop. In 1847, although the fly was seen on the 16th of July, no injury was done to the crop. In 1848, it was but slightly injured; but the year 1849 was particularly marked by the ravages of the caterpillar, as well as that of 1852.

Colonel Whitner further observes that these worms appear in successive broods, and accomplish the cycle of their transformations in from twenty-six to thirty days, which has also been corroborated by others.

A caterpillar hatched from the egg, under my own inspection, however, passed twenty days before webbing up; but, as it had been kept in confinement in a cold room, most probably the growth was not so rapid as it would have been in the open air and exposed to the warmth of the sun. The skin was shed five times during the period of its growth, and on the twentieth day, the caterpillar began its web.

In a very interesting communication from Mr. E. N. Fuller, of Edisto Island, South Carolina, he describes the depredations of the caterpillar in his neighborhood as follows:—

"In 1840, I discovered their ravages, confined to the luxuriant portions of the fields, near the seacoast of this Island. The larvæ were destroyed in the latter part of September. In 1843, they were first heard of by the 1st of September, when their ravages, limited as in 1840, were quite perceptible at some distance. A frost on the 18th of that month probably destroyed them. In 1846, they appeared on the 20th of July; and, by the 10th of September, I suppose there was scarcely a cotton leaf or any tender portion of the plants remaining, and the worms not fully grown deserted the ravaged fields in millions in search of food, failing to find which they died from starvation. The crop of this Island was about 40 per cent. of an average one. In 1849, the caterpillars made their first appearance on the 22d of August; their ravages this year, being confined to the low spots, caused no injury of moment. In 1852, they were found on the 10th of August, about 40 miles to the southward, and on this Island about the 20th of the same month. They disappeared here, however, without doing injury.

"Thus they have appeared at regular intervals of three years. In 1855, when they were again looked for, an intense drought from the early part of July was sufficient to prevent their increase, had they made their appearance. The old planters say that, in 1804 and in 1825, they appeared as in 1846; that is, in periods of twenty-one years.

"As near as I can judge, not having made any record, the length of time from the hatching of the egg to the chrysalis is twelve days; remaining four days in the chrysalis state and six days more to the hatching of the egg. This seems to be the case in a season of moisture and heat, without which, their progress would probably be more slow."

Among the many remedies recommended for this fly, or moth, fires and lights in the fields have been highly spoken of as attracting and destroying the miller. But even this may have its disadvantages, as Colonel Whitner, who has tried it, states that "it not only attracts the flies from other plantations, but that multitudes of moths perished in the flames." An article likewise appeared in some of the Southern papers, not long since, recommending white cotton flags, about a yard square, to be placed in the field, by which the moths are attracted, and upon which they deposit their eggs. Plates similar to those recommended for the boll-worm have also been used with partial success. But, to destroy this pest, it will be necessary to ascertain exactly the date of the appearance of the first moths, and then to exterminate them in the best manner, and as quickly as possible. Could not some favorite aliment be found on which the moth prefers to feed, as in the case of the tobacco-fly, and then poison them with some effective agent? This would at once rid the fields of the first broods of moths, the progeny of which, in the second and third generations, might devastate half the fertile plantations of the South.

THE GRASS CATERPILLAR.

Another insect, (Pl. VI. fig. 6,) which is often found in cotton-fields, and mistaken for the real cotton-caterpillar, is commonly known by the trivial name of the "grass-worm," or "caterpillar," owing to the circumstance of its most natural food consisting of grass and weeds, although, when pressed by hunger, it will sometimes eat the leaf of the cotton-plant.

These caterpillars were very numerous in the vicinity of Columbus, in Georgia, about the end of September and the beginning of October, 1854. They devoured grass, young grain, and almost every green thing which came in their path. Instances have been known in which, urged as they were by necessity and starvation, they actually devoured stacks of fodder that were stored away for winter consumption. Deep ditches cut in the earth to stop them were immediately filled up by the multitudes which fell in and perished, while eager millions still rushed over the trembling and half-living bridge, formed by the bodies of their late companions, bent on their mission of destruction and devastation.

These caterpillars do no essential injury to the cotton, especially when weeds abound, as they content themselves with the grass growing between the rows; and, unless very numerous, they cannot be classed among those doing much harm to the general crop, and are mentioned here principally as having been so frequently mistaken for the real cotton-caterpillar. When pressed by necessity, however, as has already been stated, they will feed upon cotton leaves. I raised about thirty of them upon this food alone, merely as an experiment, and they grew and perfected their transformations, although appearing to prefer a grass diet if it could be obtained. When about to change, they formed cocoons of silk under stones or in the ground near the surface, interwoven with particles of earth, and came out perfect moths from the 24th to the 30th of October; and, as these specimens were kept in a room without artificial heat, I conjectured that those in the open fields would appear about the same time.

At a plantation in the vicinity of Columbus, where the caterpillars were very numerous, and had already devoured all the grass on one side of a field, which was divided into two equal parts by a broad and sandy carriage-road passing through the centre of it, the grass on the other side having been untouched, it was interesting to observe the operations of numerous colonies of ants that had formed their holes or nests in the road, and were lying in wait for any unfortunate grass-worm, the natural desire of which for a fresh supply of food, should tempt it to cross this dangerous path. First, one ant more vigilant than the rest would rush to the attack; then another, and another, until the poor caterpillar, entirely covered by its pigmy foes, and completely exhausted in strength by its unavail-

ing efforts to escape, was finally obliged to succumb to superior numbers and die as quietly as possible, when the carcass was immediately carried off by the captors to their nests, or, when too heavy to be dragged away at once, they fed upon it as it lay in the road. This warfare was carried on every day as long as the grass-worms prevailed, and no doubt their numbers were diminished in this way to a considerable extent.

The grass-caterpillars, when in confinement, very often kill and devour each other; and, when one is maimed in the least, it stands a very poor chance for its life. Several intelligent planters state that, when the grass and weeds are entirely devoured, and no other vegetable food is to be found, they will attack each other and feed upon the still living and writhing bodies of their former companions. One grass-caterpillar, which was kept in confinement, although furnished with an abundance of green food, actually appeared to prefer to feed upon other caterpillars, no matter of what kind, so long as their bodies were not defended by long, bristling hairs, or spines.

The grass-caterpillar is from an inch and a half to an inch and three-quarters in length. A longitudinal light-brownish line runs down the centre, and two yellow lines along each side of the back, which is somewhat veined with black lines, and is of a dark color, marked with black spots, from each of which grows a short bristle, or hair. Below these yellow stripes, the sides are of a dark color, almost black; beneath this, extends a light-colored line, in which the spiracles are placed; the lower part of the body is of a dirty green, spotted with black; the head is black, marked with two lines of a yellowish color, forming an angle on the top; the body is somewhat hairy. This caterpillar has six pectoral, eight ventral, and two anal feet.

The above description applies only to the brightest-colored specimens of the grass-worm, as they vary much in color and markings, some of them being almost black, and showing indiscriminately their stripes. The chrysalis is brownish-black, and is formed in a cocoon of silk under the ground, the sand and small pebbles being so interwoven with it as to cause the whole cocoon to appear like an ovoid ball of earth; but it is never found webbed up in the leaves, as is the case with the true cotton-caterpillar, already described. The moth measures about an inch and one-fifth across the wings when they are expanded; the upper-wings are grey, slightly clouded with a darker color, and a lighter spot or ring is faintly seen in the centre; the under-wings are of a yellowish-white, shaded with grey along the margin near the upper wings.

Specimens of these caterpillars were brought to me when at Savannah, in Georgia, and they were suspected to have injured the rice in that vicinity in the month of June. Colonel Whitner, of Tallahassee, in his interesting communication to this Office, speaks of the grass-caterpillar as having stripped fields of grass, in 1845, and also as attacking the corn, sugar-cane and upland rice. It has likewise been said that an insect similar, if not identical with the grass-caterpillar, destroys the leaves of the sweet potato. Thus it appears to be almost omnivorous, and not choice in its selection of food, like the

true cotton-caterpillar, which is believed to confine itself to the cotton-plant alone.

The grass-worm cannot be classed among those insects very injurious to cotton, although instances have been known where it has destroyed the foliage to some extent. It is more especially mentioned here as being found in cotton-fields, and often confounded with the true cotton-caterpillar. The difference, however, is more plainly described under the head of the latter.

The same remedies are applicable to this insect as have been suggested for the boll-worm caterpillar, or any other night-flying moth.

THE RED SPIDER.

(*Acarus?*)

Much injury is done to the cotton-leaf by a minute red spider, (Pl. VI. fig. 7,) which presents very much the appearance of incipient rust, except that the leaf is of a more rusty-brown in spots, instead of the bright-yellow of the real rust. This red spider principally attacks the under side of the leaf, the spots caused by its punctures turning brown, and finally increasing until it is completely stung all over, and falls from the plant.

This insect is extremely minute, and when on the leaf, it can scarcely be discerned by the naked eye. Some of the young appear to be of a greenish cast; but, when they are advanced in age, the abdomen assumes a dark crimson shade, with darker maroon spots upon its upper surface. The legs, which are hairy, are eight in number.

This family of the mites (acari) do much injury to vegetable life, as they are so extremely minute as to escape the notice of the superficial observer. When they infest grape-houses, or rose-bushes, it has been recommended to dust the leaves while moist with flour of sulphur.

THE DROP OR HANG-WORM.

(*Œcticus?*)

The "drop-worm," as it is commonly called, (Pl. VI. fig. 8,) is occasionally found upon the cotton-leaf, but generally infests the arbor-vitæ, larch, and hemlock-spruce. It is also found upon many of the deciduous-leaved trees, such as the linden, negundo, and maple. Dr. Harris states that the female worm never quits her case, but lays her eggs in the skin of the chrysalis, in which she herself also remains until the eggs are all deposited, when she closes the end with down, and crawls out of the case and dies. These eggs being hatched, the young worms, after they are hatched, make little silken cocoons, open at both ends, and are covered with fragments of leaves, twigs, &c., in which they conceal themselves, and drag them about wherever they move. These cases are enlarged as the insects increase in size, and are still carried about by the worms. When they change

their places, they protrude their heads, the first three segments of the body, and six legs, from one end of the case; but, when the insects wish to rest, each case is fastened by a few threads to the leaf or branch, and they retreat within. When shaken from the tree by an accident or by high winds, the worms are able to suspend themselves by means of small threads, and hang in the air; hence the name. When young, they are often blown from tree to tree, and thus carried to a considerable distance from the place where they were hatched.

The males and their cases are much smaller than those of the females, the worm being only about an inch in length. The first three segments of the body are whitish, marked with black lines and spots, the segments where they join are brownish; the head is marked with wavy lines of black on a white ground; the rest of the body is of a dirty, blackish-green. It has six pectoral feet, by means of which it moves from leaf to leaf, with its body and case, the latter either perpendicularly suspended in the air or dragged by the worm from behind. There are eight very small ventral, and two anal feet, by means of which it clings to the inside of the case. The chrysalis measures about three-quarters of an inch in length, and contains the rudiments of wings, legs, head, and antennæ, like other moths, and is of a dark-brown. The perfect moth comes out in autumn, and measures across the expanded wings about an inch and three-twentieths Its body is downy, and of a blackish-brown; the wings are semi transparent, and scantily clothed with blackish scales, which are blackest on the margins and veins; the antennæ are covered at their tips, and are doubly feathered from the base to beyond the middle. The female is much larger than the male, and never leaves her case, but changes into the perfect insect in the shell of the chrysalis, and only emerges from it when the eggs are laid within. The young, after leaving their maternal case, in the spring, immediately commence their cases, and spread over the native tree or any others that may happen to stand near.

These insects are a great nuisance wherever they once get established, as they are exceedingly prolific. One female chrysalis case, which was dissected, contained seven hundred and ninety eggs, while others have been found to contain nearly a thousand.

These pests are very rarely seen on the cotton-plant, and even when such is the case, they may have been blown there from the cedars, maples, or other deciduous-leaved trees in the woods on the edges of the plantations. They are the more particularly mentioned here, from the fact that, if taken in time, they may easily be exterminated on deciduous-leaved shade-trees; for, as I have before stated, the female cases contain all the eggs, which may be seen in winter hanging on the branches when the leaves have fallen, and even are large enough to be distinguished when on evergreens. It would therefore require but little trouble to pull them off in the autumn and winter, and burn them, so that neither males nor females should escape. If this course were pursued two or three years in succession, there would not be so many complaints in our cities about the drop-worms destroying the foliage of the trees.

THE CORN EMPEROR-MOTH.

(*Saturnia io.*)

The foliage of the cotton-plant is also eaten by the caterpillar of a large moth, denoted on Pl. VI. fig. 9. This spiny and stinging caterpillar is often found upon the leaf of cotton in September; it feeds likewise upon the blades of Indian corn, and the leaves of the willow, balsam-poplar, dogwood, and many other trees. Whenever one of them is found in a field, the plants attacked by it may be easily distinguished by their leafless appearance in the midst of the otherwise green and flourishing vegetation, as it rarely quits a plant before it is completely denuded. Often, however, those which have lost their leaves from the rust present much the same blighted appearance; but, in this case, the numerous yellow, withered leaves, which are scattered on the ground, at once indicate the disease.

The thorny spines with which these caterpillars are armed have a peculiarly poisonous property, and are capable of inflicting painful and severe wounds, similar to the sting of a wasp. It is therefore necessary, if the insects require to be touched, to use a stick or branch, when removing them from the plants on which they feed.

These caterpillars cannot be classed among those very injurious to cotton, as they do not appear to be sufficiently numerous to effect much damage. Very few complaints have been made about them by the planters either of Georgia or South Carolina; but this year, (1855,) the same caterpillar was found very abundant in the cotton-fields near Tallahassee, but the damage done by them was trifling.

Mr. Newman, of Philadelphia, who has paid much attention to the breeding of caterpillars, states that this insect is found on the willow. Dr. Harris says, they are also found upon the balsam-poplar and elm, in Massachusetts; and, according to Smith and Abbot, in their "Insects of Georgia," it is found on the dogwood, sassafras, and Indian corn, which are devoured by them.

This caterpillar is from two inches and a quarter to two inches and three-quarters in length; but, as Dr. Harris has minutely described them, I will quote his own words:

"The caterpillars are of a pea-green color, with a broad, brown stripe, edged below with white, on each side of the body, beginning on the fourth segment and ending at the tail. They are covered with spreading clusters of green prickles, tipped with black, and of a uniform length. Each of these clusters consists of about thirty prickles, branching from a common centre, and there are six clusters on each of the rings, except the last two, on which there are only five, and on the first four rings, on each of which there is an additional cluster low down on each side. The feet are brown, and there is a triangular brown spot on the under-side of each ring, beginning at the fourth." The brown stripe mentioned by Dr. Harris is often of a reddish-brown, and, in high-colored and healthy individuals, I have seen it almost of a carmine red.

The caterpillars are gregarious when young; but, when older, they are solitary. When fully grown, they form a brownish cocoon of a

gummy substance among the leaves, resembling parchment. The perfect moth comes out the following spring. It is said that there are two broods of these insects in a season, in the Southern States; but I have not observed the caterpillars on cotton later than September.

The chrysalis is brown, and of a short, thick form, with a number of hooked bristles on the tail.

The following is Dr. Harris' description of the moths: "They sit with their wings closed and covering the body like a low roof, the front edge of the under-wings extending a little beyond that of the upper-wings and curving upwards. The sexes differ both in color and size; the male, which is the smallest, is of a deep or Indian-yellow color; on its fore-wings there are two oblique, wavy lines towards the hind margin, a zigzag line near the base, and several spots so arranged on the middle as to form the letters A H, all of a purplish-red color. The hind-wings are broadly bordered with purplish-red, next to the body, and near the hinder margin there is a narrow curved band of the same color. Within this band, there is a curved, black line, and on the middle of the wing a large, round, blue spot, having a broad, black border and a central white dash. The fore-wings of the female are of a purplish-brown, mingled with grey; the zigzag and wavy lines across them are also grey, and the lettered space in the middle is replaced by a brown spot surrounded by an irregular grey line. The hind-wings resemble those of the male in color and markings; the thorax and legs are purplish-brown, and the abdomen is ochrey yellow, with a narrow, purplish-red band on the edge of each wing. These moths expand from two inches and three-quarters to three inches and a half."

The only method that can be taken to destroy these insects would be to kill the moths when and wherever found, and to strike the caterpillars from the plants and then crush them under foot. Although they cannot properly be classed among the insects very injurious to cotton, not being sufficiently numerous to do much harm, yet, if left undisturbed, they may so increase as to become a nuisance to the planter both of cotton and corn.

THE COTTON TORTRIX.

(*Tortrix?*)

When the margins of the leaf of the cotton-plant are found rolled up and fastened to the main part by means of a loose web of silk, it is often discovered to be the work of the small tortrix, (Pl. VII fig. 1.,) which makes this shady retreat in order to shelter itself from the sun and rain, as likewise for a place of concealment from birds and other enemies. Sometimes, however, these leaves are similarly rolled up by a spider, as a suitable nest or receptacle for its eggs; but, when this is the case, the inside will be found to contain a silken bag in which the eggs either have been or are about to be deposited.

When disturbed, this caterpillar always retires into its place of shelter, and, if forcibly driven out, it is able to retreat backward from the open end, and to suspend itself in the air by a thread, which issues

from its mouth, having previously fastened the other end of this thread to the leaf from which it had fallen. The leaves attacked by this moth can be distinguished from those that are perfect, by their rolled-up and distorted appearance; and either this insect, or one very similar in habits and appearance, sometimes attacks the young and tender ends of the cotton-shoots, which are often seen webbed up into a mass and partially eaten out.

The caterpillar, when full grown, is about an inch in length, of a bright-green color, with a brownish or black head, and has a helmet-shaped black mark on the first segment of the body. It has six pectoral, eight ventral, and two anal feet; the two anterior pair of pectoral ones being dark-colored.

The chrysalis measures from three-fifths to seven-tenths of an inch in length, is of a brown color, somewhat spiny, and furnished with four hooks at the end of the tail, by which it is enabled to hold fast to its web. The chrysalides were formed in semi-transparent cocoons of loose silk among the leaves; and in about fourteen days, the perfect moths came out. The moth at rest has a somewhat bell-shaped appearance, the upper-wings suddenly becoming quite broad a short distance from the thorax. They are of a chestnut-brown color, with an oblique dark-brown band forming an obtuse angle near the middle; and, on the inner margin of each wing, a rather more indistinct band runs near the body. The tips are also banded with dark-brown. The under wings are yellow, with a blackish-colored mark on their margins and sides, while the under-side is yellow and more or less shaded.

I should judge, from the small numbers of these caterpillars, that they do comparatively little, if any injury to the main crop, and no doubt the moths would be attracted by lights or fires placed in the field at night, as recommended for the moth of the cotton-caterpillar. The same plan would also serve to diminish their numbers, should they ever increase.

THE YELLOW CATERPILLAR.

There is a yellow, hairy caterpillar found on the cotton-plant in September and October, which devours the leaf. The specimens observed in South Carolina and Georgia appeared to be of solitary habits, not congregating together, like the cotton-caterpillar and grass-worm, but feeding alone on the plant.

The young of these insects are of a much lighter color than those nearer maturity. The ground color of the old caterpillar is yellow, profusely specked and shaded with small black dots; a yellow longitudinal line runs along the side below the spiracles; on each segment of the body, rise numerous small yellowish-brown excrescences, or warts, from which issue tufts of long brownish-black hairs. The head is black, with a yellow stripe running down the middle. It has six pectoral, eight ventral, and two anal feet. The cocoons are ovoid in shape, formed on or near the surface of the ground, and constructed of silk intermingled with gravel, particles of soil, and the hairs from their own bodies. These caterpillars are reputed to be capable of

stinging; but, as I repeatedly handled them with impunity, their poison, if any, cannot be very powerful.

The chrysalides, which are dark-brown, approaching to black, appeared about the end of September, and were quite short and thick. I cannot describe the perfect moth, as, unfortunately, the chrysalides did not live to perfect their last transformation. These caterpillars, although described as infesting cotton, cannot be classed amongst those very injurious, as they did not appear in numbers sufficient to injure the general crop.

There is a red, hairy caterpillar of like characteristics, that sometimes eats the cotton-leaf, but which it is unnecessary to describe here.

THE COTTON ARCTIA

(*Arctia?*)

A species of arctia (Pl. VII. fig. 2) was also found in Tallahassee, in the month of July, upon the cotton-plant; but, most probably, the parent moth had wandered away from its more natural food, as the identical kind of caterpillar was found at the same time upon the brambles by the roadside near that place. The plant attacked, however, was in the middle of the field, and not near any brambles nor weeds, on which the eggs might have been laid. The bare stem and branches of the cotton were covered with the unsightly web, and all but a few straggling caterpillars had disappeared, having probably webbed up preparatory to the final change.

The full-grown caterpillar is from an inch and one-tenth to an inch and three-tenths in length; the back, dark-colored, and covered with tufts of long, blackish-grey hairs; the sides are of a pale-greenish color, with a line between the black and green distinctly marked; the six pectoral feet and head are black, and the eight ventral and two anal ones are green.

The chrysalides were formed on the 24th of July, in cocoons or loose webs, intermingled with its own hair, and spun under the loose leaves. They were nearly half an inch in length, short and thick in form, and brown in color. The moths came out in about twelve or fourteen days.

The wings of the male measure, when expanded, from nine-tenths of an inch to an inch across, and are white, with one or two black dots near the centre of the upper pair; the eyes are black; the antennæ feathered, and the two fore-legs of an orange color.

The female is much larger than the male, measuring about an inch and one-fifth across the expanded wings. She is very similar to the male in color, but has no black spot on the upper-wing; nor are the antennæ feathered as in the male.

I consider, from the circumstances under which the nest, or web, of caterpillars was found, that it was accident alone which caused their presence on the cotton, as I have never seen them before nor since, in any number, among the plants. Therefore, they may be classed among those insects which cause little or no harm to the general crop.

These moths are similar to the *Arctia textor*, of Harris, but appear to differ from them in the spots on the upper-wings of the male, and in some other slight particulars. The habit of webbing up the limbs is also the same.

INSECTS FOUND ON THE TERMINAL SHOOTS.

The insects attacking the terminal shoots of the cotton-plant are at present very little known; but when their habits shall have been more thoroughly investigated, there is no doubt that they will be found to be much more destructive than is generally supposed.

No practical planter can have passed through his cotton-fields, without frequently observing that the terminal leaves of many of the plants have been webbed up and eaten out, or that many of the young blossoms have suddenly turned brown, or "flared" open, and, on the slightest touch, fall to the ground. Some of this damage may no doubt be caused by excessive moisture, or heat, or by an unhealthy state of the plant itself. But if the ends of all the shoots be closely examined, it will generally be found that several minute insects lie hidden between the folds of the leaves and buds, probably feeding upon the tender foliage, or extracting the sap. The aphis, or cotton-louse, is often found in such places.

THE PEA-GREEN CATERPILLAR.

In the cotton-fields near Tallahassee, many of the tender leaves and young blossoms of vigorous and healthy plants were observed to be webbed together in a mass. Upon opening one of them, a small caterpillar, (Pl. VII. fig. 3,) between three-fifths and seven-tenths of an inch in length, was discovered feeding upon the interior. This caterpillar is of a pea-green color, with a dark longitudinal stripe running down the middle of the back, and a row of two dark spots with white centres to each on every segment of the body, except the first, running parallel on each side of the dark stripe. The head is black; the first segment of the same color, with a dividing line of white between it and the head, and another light division between this and the second segment. The pectoral feet are black, and the body sparingly clothed with short bristles, or hairs.

This caterpillar, for the most part, lives and feeds in the terminal shoots; but I have found it webbed up between the outer calyx and boll of the cotton, or in the calyx of the flower.

The chrysalis, which is of a light-brown color, is about two-fifths of an inch in length, and is formed in the same webbed-up terminal shoot which served the caterpillar as a shelter. It shed the caterpillar-skin about the 27th of September, and the perfect moth came out in about ten days.

The moth, when expanded, measures from three-fifths to seven-tenths of an inch across the wings; the body and thorax are of a

brown color; the upper-wings light-brown, with a band of darker brown, running obliquely across them near the centre (one specimen had two dark oblique lines on the upper-wing); a dark triangular mark occurs on the upper side of the wing; between the margin and band, and the margin itself is of a dark-brown; the under-wings are yellowish-brown; the under side of the wings is brown, marked crosswise by darker lines, giving it somewhat a marbled appearance; and the antennæ are threadlike. The distinguishing feature of this small moth is the very long and dark-colored palpi, which are somewhat curved upwards, and project from the front of the head like a trunk.

The damage done by these small insects is not so apparent at first as that caused by those of a larger size, such as the boll-worm and others; yet, no doubt, many of the buds and leaves on the terminal shoots are destroyed by them. These webbed-up leaves, however, must not be confounded with the webs made by numerous small spiders, which also select such places for their abodes, and no doubt do good by destroying many young caterpillars and moths.

Young cotton-buds are frequently observed at the end of the terminal shoots, turning brown, and eventually dropping off. This has been attributed to the agency of the young larvæ of the "bore-worm," or "boll-worm," which certainly are sometimes found in the terminal shoots of cotton; but, when this is the case, the buds are generally either eaten from the outer calyx, or the bud itself perforated and the former flaring open; whereas, the buds, which turn black, as before described, are closely enveloped in the outer calyx, and present a triangular form with a dry and dark-brown appearance.

THE COTTON LYGÆUS.

(*Lygæus?*)

Upon close examination, a number of extremely minute larvæ, (Pl. VII. fig. 4,) measuring a little over one-twentieth of an inch in length, were found in the injured shoots. The insects, when confined in a bottle with some young terminal cotton-shoots and buds, to ascertain if they really injured the plant, were observed immediately to attack each other with great animosity; and, in a short time, one of the strongest larvæ killed and sucked out the juices from three of its companions, and also from a cotton-louse which had been placed in the glass. The same insect, however, was afterwards plainly seen on several occasions, to suck sap from the terminal shoot and young buds; and as there were no more insects for it to feed upon, it must necessarily have perfected its growth and transformations afterwards on vegetable juices alone. Almost every terminal shoot which was diseased had in it one or more of these minute larvæ or perfect insects.

The pupæ are of a reddish-brown, about one-twentieth of an inch in length, with eyes of a reddish-brown color. The perfect insect is rather more than one-twentieth of an inch in length, also with reddish-brown eyes, yellowish antennæ, and a head and thorax black; the triangular space between the wings is black; the wings are brown-

ish-yellow, barred in the centre with two triangular black marks; the ends of wings diamond-shaped, of a light color; the upper part of the thigh is black; and the rest of the leg yellowish.

This insect is more especially mentioned here in order to draw attention to the various tribes which attack the terminal shoots of cotton, as at present very little appears to be known about them, and immense numbers of young buds dry up and fall in the manner mentioned above, unobserved from their minute size. Many of them are no doubt cast in consequence of atmospheric and various other causes; but, as this small insect has been observed sucking the juices from the plant, it may be found that several others do the same thing in different localities. The young boll-worm is, no doubt, found in these shoots; but I very much doubt whether the fallen blackened buds are owing to injuries received from it, as will be seen in the article on that worm. It is true, the young boll-worm causes many immature forms to drop, but in such cases the bud attacked generally shows where the injury has been done, by a small puncture.

As several of the reduvii or cimicidæ, have the power of stinging man and animals in a very severe manner, with their probosces, or piercers, may they not in some measure possess the same power over vegetable life? The question is merely asked to lead to further enquiries on the subject.

SAP-SUCKERS.

Another insect, (Pl. VII. fig. 5,) found in the young shoots and newly-formed bolls, the color of which is green; the eyes reddish brown; the legs green, with the thighs red; the antennæ are four-jointed, and also green, with red at the end of each joint. The pupa is about a quarter of an inch, and the perfect insect is seven-twentieths of an inch in length; the antennæ are brown and green, the eyes brown; the thorax somewhat triangular; the anterior part green, and shaded with reddish-brown, posteriorly; the legs, brown and green; the wing-cases with a cross, shaped like the letter x, forming four triangles, those nearer the thorax being reddish-brown; the side triangles are green.

I observed these insects, when confined under glass, sucking the sap from the buds and young bolls, their only food. The young eventually completed their transformations into perfect insects. They were observed, moreover, to eject large drops of green sap from their abdomens, which could only have been procured from the buds themselves. As it has been already seen that these insects puncture the bolls and extract the juices therefrom, the question arises whether they do any material injury, either by this extraction of the sap, or by a poisonous sting, like some of the reduvii.

There is likewise another of the same species of insect, (Pl. VII. fig. 6,) which was found perforating the young flower-buds and bolls of the cotton, similar to the above. The head and anterior portion of the thorax are reddish-brown, the remainder of the thorax yellow, with a double dark mark in the middle; the wing-cases are brownish-black, with two longitudinal yellow lines from the upper

outside corner of the wing-cases to the posterior edge, forming a dividing mark somewhat shaped like the letter x.

THE CENTRINUS PERSCILLUS.

(Denoted by Pl. VII. fig. 7,) about three-twentieths of an inch in cngth, of a greyish color, with a rather long, curved rostrum, or bill, was found in the terminal shoots, as well as in the blossom; but I could not perceive that in any way it injured the plant. I have also seen very young boll-worms in the terminal shoots, but, upon examination, I have generally found the egg deposited upon the outer calyx of a young bud or boll, the parenchyma, or tender succulent substance, of which, was mostly eaten, and the young bud pierced or its contents sucked or eaten out.

INSECTS FOUND ON THE FLOWER.

The flower of the short-staple cotton is of a yellowish-white color the first day of its blooming; it then gradually assumes a pinkish tinge towards its outer edge; the second day, it partially closes, turns pink, and presents such an entirely different appearance that it can scarcely be recognised as the same flower.

There are several insects which infest this flower, or "bloom," as it is frequently termed, some for the sake of the nectar, or honey; others for the pollen; and a few for the corolla itself.

THE BLISTER-FLY.

(*Cantharis strigosa.*)

Several blister-flies, or cantharides, found in Columbia, South Carolina, were seen to devour the petals of the cotton-flower. One of these insects is a little more than half an inch in length, (Pl. VII. fig. 8,) of a reddish-brown color, with the eyes and a spot on the head black. Two long black marks are seen on the thorax, and two longitudinal stripes, also black, on each wing-case; the legs and antennæ are black; and the abdomen protrudes somewhat beyond the wing-cases. Some of them are smaller than others, measuring not quite half an inch in length, and are of a rusty ash-grey white; others are of the same color, but with two broad, longitudinal black stripes on the elytræ. The two last mentioned vary so much in the distinctness of their stripes, some of them being the medium between the perfectly grey and the striped, that it is somewhat difficult to determine whether they are the same insect or not. The under-wings are clouded, and nearly black.

These insects, although they eat holes in the petals, do but little, if any damage to the crop; yet, together with the chauliognathus,

bees, and wasps, may, perhaps, be beneficial, as serving to fecundate many plants by carrying the pollen from flower to flower.

THE COTTON-CHAULIOGNATHUS.

(*Chauliognathus pennsylvanicus.*)

This insect (Pl. VII. fig. 9) does not appear to attack the petals in the same manner as the cantharides, just described, but contents itself with the pollen or nectar, which is found in the flower, where it may be often seen so much occupied in feeding as scarcely to take any notice of the approach of mankind. It is so plentiful near Columbia, in South Carolina, that four or six may be taken from one bloom alone. When issuing from the flower, they sometimes appear to be so abundantly powdered with pollen as to be perfectly yellow, and no doubt serve in some measure beneficially, as a medium for transporting the pollen and fertilising other blooms.

This insect is not quite three-quarters of an inch in length; its head, eyes, and antennæ are black; its thorax, orange, with a large, dark spot in the centre; its wing-cases are orange-yellow, with a black, longitudinal, broad stripe running down each, near the inner margin, leaving a narrow inner and broad outer margin of yellow orange. This black stripe grows broader towards the abdomen, leaving a narrow stripe, also of yellow, at the end of the elytræ. Its legs are black.

THE YELLOW-MARGINED-WINGED CHAULIOGNATHUS.

(*Chauliognathus marginatus.*)

A small species of chauliognathus is found in Florida, (Pl. VII. fig. 10) where it appears to take the place of the last mentioned insect, having the same habits, and occuring in the same places. It is nearly half an inch in length; the head is orange-yellow, with a black mark below the eyes, which are also black; the thorax is yellow, with a longitudinal black mark down the centre; the wing-cases are black, edged around the outer and inner margins, and the end with orange-yellow; the lower part of the thighs is also orange-yellow; the upper part and rest of legs and antennæ are black.

This insect frequents the flowers of the cotton, but, as yet, I have never discovered it doing any injury.

THE DELTA-THORAXED TRICHIUS.

(*Trichius delta.*)

A small beetle, which is a little more than two-fifths of an inch in length, (Pl. VII. fig. 11,) is also found in cotton-blooms, and sometimes on the bolls. The head is black, including several white marks; the thorax is also black, bordered with yellow, containing a singular triangle of yellow lines, the lower end of which appears as if broken

off; the wing-cases are reddish-brown, with two oblique black spots on the upper, and two longitudinal black ones enclosing a yellowish mark on their lower parts; the abdomen protrudes the twentieth part of an inch beyond the wing-cases, and is of a yellowish color; the fore-legs are spiny and of a brown color; the hind-legs are very long, brown, the ends of the tibiæ and tarsi black.

From what has been seen of the habits of this insect, and its comparative scarcity, I should not regard it as injurious to the crop, and therefore, I would class it amongst those insects frequenting the cotton but not injurious to it.

TWELVE-SPOTTED GALEREUCA.

(*Galereuca duodecimpunctata.*)

A small leaf-beetle (Pl. VIII. fig. 1) is often found in the young flowers of the cotton, where it gnaws holes in the petals. This insect is about three-tenths of an inch in length; the head is black; the thorax orange-green; the wing-cases greenish-yellow, with six black spots on each; the upper part of the thighs is green, and the rest of the leg dark-colored, or nearly black.

Among the remedies suggested for destroying the striped cucumber-beetle, (*Galereuca vittata*,) Dr. B. S. Barton, of Pennsylvania, recommends "sprinkling the vines with a mixture of red pepper and tobacco." Ground plaster and charcoal dust have also been recommended, as well as watering the vines with a solution of an ounce of glauber salts in a quart of common water, or tobacco water. An infusion of hops, elder, or walnut leaves is said to be very useful; as, likewise, sifting powdered soot upon the plants when they are wet with the morning dew. Others have advised sulphur and Scotch snuff to be applied in the same way.

Dr. Barton likewise states that, "as these insects fly by night, as well as by day, and are attracted by lights, burning splinters of pine knots, or of staves of tar-barrels, stuck in the ground during the night, around the plants, have been found useful in destroying these beetles." Similar remedies might possibly apply to the twelve-spotted galereuca.

As these insects are not sufficiently numerous to do any harm to the cotton-crop, these remedies are merely mentioned as applying to the cucumber-beetle, or any other pests of the garden or fields, of similar habits.

SPAN-WORMS, OR LOOPERS

(*Geometræ?*)

Among the numerous insects which injure the flowers of the cotton-plant may be found several caterpillars, many of which are of the kind termed "loopers," or "span-worms," from their peculiar mode of locomotion.

Near Columbus, in Georgia, I found a species of caterpillar, (Pl. VIII. fig 2,) which were quite numerous, about an inch and a half in length, and of a bright-green color, eating the petals of the cotton-flower, from the 12th of October to the 29th of November. They had six pectoral, four ventral, and two anal feet, and were obliged to loop their bodies when progressing from place to place, after the manner of the so-called span-worms, or loopers. Their bodies were green, and slightly hairy. The chrysalides were seven-tenths of an inch in length, and of a green color. The moth, with wings extended, measures about an inch and three-tenths, is of a shaded or clouded blackish-brown, with a metallic, gold-colored semi-circle near the centre of each upper-wing; a round spot of the same color also lies close to it, but nearer the margin; the under-wings and body are of the same blackish-brown. When at rest, the upper-wings come together like the roof of a house; a tuft of hair projects from the upper part of the thorax, and a smaller tuft is found near or between the junction of the wings, which appear to curve up towards the outer margin.

ANOTHER CATERPILLAR

Is of the same habits, size, form, and color, except that it has a white longitudinal line running down each side. The chrysalis, however, is of a dark-brown color, whereas, that of the preceding is always green, with dark-brown markings only on the thorax and back. The moth also is similar in shape and color—so much so, indeed, as to warrant a belief that they may be different sexes of the same species.

Mr. Peabody, of Columbus, states that this caterpillar was very destructive to the leaves of turnips, in 1854. Several, which were placed in confinement, were attacked by a singular and fatal disease. However healthy they appeared at first, they gradually assumed a lighter color, ceased feeding, became swollen, and, suspending themselves by the hind feet to any projecting twig, very soon died and became putrid and black.

These caterpillars were quite plentiful in the vicinity of Columbus, but were not found in Florida the following year. They cannot be classed among insects very injurious, as they were not sufficiently numerous to harm the cotton.

THE SMALL COTTON SPAN-WORM.

A very small looper-caterpillar, or span-worm, (Pl. VIII. fig. 3,) about seven-tenths of an inch in length, of a brown or greenish color, with five yellow and black markings or bands on the middle segments, and of about the thickness of a knitting-needle, was very numerous on the blossoms of cotton in Georgia during the month of October.

These caterpillars, having six pectoral, with only two ventral, and two anal feet; their mode of progression is by alternately stretching out and contracting the body in the form of an arch. They are thus enabled to advance nearly half their length every stride, or step,

and, from this circumstance, derive their common name of "span-worm," or "looper."

The favorite food of these insects appeared to consist of the petals. In some places, they were very numerous, as many as four having been taken from one bloom alone. In color, they varied much from green to brown; but both were similarly banded with another color. The chrysalides were fixed by the tail to the leaves with a glutinous matter or silk, and measured about seven-twentieths of an inch in length; were of a brownish-green color, and remarkable for having the upper part of the thorax somewhat square, flat, and furnished with two minute protuberances, or spines, over the head and eyes. When disturbed, they instantly drop from the leaves, and suspend themselves in mid-air, by means of a thread, which issues from the mouth; and although exceedingly abundant in one part of the field, yet they were scarcely to be found out of that particular spot.

As these insects are very small, and eat holes in the petals of the flowers alone they cannot injuriously affect the general crop.

THE LARGER SPAN-WORM.

Another span-worm, or caterpillar, (Pl. VIII. fig. 4,) appears in the Carolinas, Georgia, and Florida, early in October, and feeds upon the petals of the cotton-flower. It measures, when fully grown, from an inch and a half to an inch and three-fourths in length; the color is reddish-brown, marked with faint, longitudinal darker stripes; the head is somewhat angular, and divided at the top; there is a light spot on each side, about the middle of the body, and two short excrescences, or warts, on the extremity. In several specimens, there are white spots running down each side of the back. The chrysalis is a little more than half an inch in length, and is of a brownish color. The moth measures an inch and three-tenths across the expanded wings, which are of a light, clouded-grey color, with an irregular, dark, oblique line running across the upper-wing, and two others, not quite so distinct, nearer the body. There is also a dark, oblique line, and another fainter one, crossing the under-wing; the margins are scalloped with a darker color; the antennæ of the specimen figured are feathered.

This caterpillar feeds upon the petals of the cotton-flower, and, when disturbed, assumes a stiff, erect attitude, in which it might easily be mistaken by men or birds, for a dried twig or stick. When about to change, in October, it descends into the earth, becomes a brownish chrysalis, and in about fourteen days the moth appears.

The caterpillars are not very numerous, and therefore can do but little harm to the general crop.

Another span-worm, somewhat similar to the above in shape and color, is very numerous in cotton-fields, but feeds upon the bind-weed flower, (convolvulus,) and does not disturb cotton.

INSECTS FOUND UPON THE BOLL.

During the time that cotton is maturing its seed-vessels, there are several insects of the "plant-bug" species found both upon the young and the old bolls; but whether these insects have anything to do in producing the rot, is a question which cannot be easily answered before further information shall have been collected upon the subject. I will here simply give the results of some experiments made by me this season (1855) to determine whether any of these insects do or do not suck the sap from the bolls. In the month of October, several plant-bugs were caught, and placed singly in glass bottles, containing young and middle-sized bolls, and all of those hereafter described were observed with their piercers penetrating the bolls, and busily engaged sucking out the sap.

THE GREEN PLANT-BUG.

(*Pentatoma?*)

This insect is about seven-tenths of an inch in length, rather broad, and of a bright-green color; the head is furnished with two ocelli on the upper part; the eyes are brown, and the scutellum, or triangular place between the wing-covers, is very large and also of a green color; the upper part of the body, which is flattened, is margined with an edge of yellow, and has a black spot on the yellow edge of each segment. The piercer, which is long and jointed, when not in use, is recurved under the thorax; the antennæ are five-jointed.

An insect was described by Mr. Bailey, of Monticello, in Florida, (Pl. VIII. fig. 5,) as being very numerous in his cotton-fields; and his overseer informed me that he had seen it in the very act of piercing a boll, which he afterwards cut open and found that the puncture had penetrated through the outer shell, or case of the boll, to the cotton, and that the mark where the piercer had penetrated was discolored. Those I had in confinement certainly were frequently seen with their trunks inserted into bolls, and sucking the sap.

The larva is very similar to the perfect insect in shape and color, but smaller in size, and is not furnished with wings. The pupa possesses rudiments of wings, only, and it is the perfect insect alone which, by means of a pair of under-wings, concealed beneath the wing-cases, is able to fly about and propagate its kind.

THE GREY PLANT-BUG.

(*Pentatoma?*)

The spotted plant-bug (Pl. VIII. fig. 6) is very much of the same shape as that last described, but is not so broad. It is grey, and marked with black dots and lines; it is also smaller than the former, being only three-fifths of an inch in length; the outer margin of the thorax is somewhat pointed or angular; the scutellum, broad and

triangular; and the wings, when closed, terminate with a black, diamond-shaped mark, where they overlap; there are two ocelli; the antennæ are five-jointed; and the appearance of the insect is flat, broad and similar to the so-called "squash-bug" of the North. This insect was often seen with its piercer inserted into a boll, extracting the sap, which was ejected from the abdomen as a bright, greenish liquid.

These insects were found plentifully on the cotton in Georgia, in 1854, and in Florida, in 1855.

THE RED-EDGED-WINGED REDUVIUS.

(*Reduvius?*)

A species of reduvius (Pl. VIII. fig. 7) was found in abundance in the cotton-fields of Florida, in 1855. The female measures a little more than three-fifths of an inch in length, and the male about half an inch. The head is of a greyish-black; the eyes prominent, black and brilliant; the antennæ are four-jointed; the thorax is triangular, with the angle towards the head, truncated, black, with an edging of red; the wing-cases are reddish, spotted with black, and edged with red, with their ends, where they overlap, black; the legs are black from half way up the thighs, where they are red; the under-wings are clouded with black veins. It so closely resembles the celebrated "red-bug" of Eastern Florida that it has probably been mistaken for it by many planters, who have stated that the true red-bug is often found in Middle and Western Florida, where none are to be found, though I searched diligently for them.

These insects, when confined in glasses, were not observed to feed upon the sap of the bolls, although it probably does some injury, like the much dreaded red-bug alluded to above.

THE LIGHT-BANDED-WINGED ANISOSCELIS.

(*Anisoscelis?*)

A species of anisoscelis (Pl. VIII. fig. 8) was found in abundance in the cotton-fields both of Georgia and Florida. It appeared to be very active and vigilant, as, however carefully approached, it always flew away with a loud, humming sound. Several of these insects were observed on a large boll, apparently busily employed; but when suddenly disturbed, they dispersed in different directions. Upon examining the boll, the sap was seen exuding from several minute punctures, which was attributed to these insects having bored into the boll for the sake of the vegetable juices contained therein.

The larva, when young, is of a light scarlet or crimson, with two black spots on the back, in which are two black, thorny excrescences, or points; there are also four black, thorny excrescences on each side; the legs, antennæ, and eyes are black; and the hind-legs thicker than the others.

The pupa is brown, with its wing-cases only in an incipient state,

and the tibiæ of the hind-legs have already attained a broad, flattened appearance.

The perfect insect is about seven-tenths of an inch in length; the antennæ are four-jointed; the eyes, prominent and brown; the piercer four-jointed, and when at rest, re-curved under the body; the ocelli are two in number; the thorax rising from the head, and somewhat angular on the margin; the wing-covers are reddish-brown, with a distinct yellowish-white band across the middle; the anterior and middle legs are reddish-brown; the hind-legs, however, are very singular in shape, the thighs being thick and spiny on their under side, and the tibia furnished with a broad flattened enlargement on each side, larger on the upper one and somewhat wing-shaped, with two teeth, or notches, on the margin. This makes the insect appear to have hind-legs entirely out of proportion to its size. These insects are very numerous in cotton-fields, and may be seen flying from plant to plant during the heat of the day.

There are several other insects found upon cotton; but those mentioned above are the most numerous. The question now arises whether they have anything to do with the "rot," or whether that disease is caused by a peculiar state of the atmosphere, or by imperfections of the soil. May not the punctures made by these insects, in some peculiar seasons, incline the boll to the rot more readily than in others, though in more favorable seasons it may be made with comparative impunity? A singular circumstance, however, is rather against the insect theory, namely, that, while some particular cotton-plant is observed to be much affected by the rot, the plants standing close to it may be comparatively free and healthy. On one diseased plant, I counted seventeen rotted bolls, while the very next plants were green, and exhibited not the least sign of disease. The query as to whether the rot is caused by insects or the peculiar state of the soil or atmosphere, is here submitted for the purpose of inciting planters to make experiments, and to report their success, in order that we may soon come to a definite conclusion upon the subject.

THE BROWNISH-BLACK ANISOSCELIS.

(*Anisoscelis?*)

A very large anisoscelis, (Pl. VIII. fig. 9,) about an inch and one-fifth in length, and of a brownish-black, I found quite numerous in the cotton-fields of Florida. The head of this insect is brownish-black, with prominent eyes; the thorax rough, black, and somewhat triangular; the antennæ, four-jointed; the legs, brown; the thighs, brownish-black and spiny; the hind-legs, in appearance, entirely disproportionate in size to the insect; with the thighs very stout, thick and spiny, and the tibiæ with broad, flattened, wing-shaped projections; the trunk is recurved under the thorax.

These insects, though somewhat numerous, were never observed to suck the sap from the bolls; yet it would be well to investigate their habits more minutely before deciding whether they are injurious or not.

THE DARK-SHADED CETONIA.

Cetonia Melancholica.

The beetle shown on Pl. VIII. fig. 9 is found on those bolls which have been bored into by the boll-worm, extracting the flowing sap from the lacerated sides of the wound. As many as five have been taken from the interior of a single boll, which had been previously hollowed out by the worm, and where the sap was flowing very freely. Some planters accuse them of making the holes in which they are found; but most of the bolls examined by me had evidently previously been hollowed out, and the beetles had only entered for the sake of the extravasated sap. Sometimes, however, they may so abrade the skin of a boll as to cause a flow of juice, of which they will avail themselves, as I have occasionally observed solitary individuals sucking the sap under very suspicious circumstances, where no previous wound had been made by the worm. They can do but little harm, however, to the crop.

This beetle is rather more than half an inch in length; of an ovoid form; greenish, with somewhat of a metallic lustre; across the wing-cases, are several whitish spots and short lines; the tail is obtuse, hairy, and protrudes beyond the wing-cases; the legs are rather spiny, of a dark color and metallic lustre.

THE INDIAN CETONIA.

(*Cetonia inda.*)

I observed another beetle, (Pl. VIII. fig. 10,) but very abundant, in the blooms, and sometimes in the open bolls of the cotton, in Florida, in October, which apparently did no injury. This beetle is three-fifths of an inch in length, and of a brown color, spotted and marbled with a darker brown and black. It flies with a loud-humming sound, and is apparently sluggish in its habits when not on the wing.

INSECTS FOUND ON ROTTED BOLLS.

Much has been said about the rotted bolls of cotton, the cause of which has been attributed to insects; and it has been alleged that, if these bolls were well examined, several of the insects causing the disease would always be found inside. It is true, many small insects are found in such rotted bolls, but they have invariably been previously cracked or split open by disease, or bored into by the boll-worm. The fact is, the insects found in such places frequent them merely for the sake of the sap which exudes from the wounds, or for the fungoid growth that generally flourishes in such situations.

It is very often the case that the effect is thus mistaken for the cause, and that insects perfectly innocent are blamed for a disease with which they have nothing to do, except that they resort to the already injured bolls for food or shelter.

The insects in decaying and rotted bolls of cotton are very numerous, but most of them are quite small.

ANOTHER INSECT

(*Carpophilus?*)

Was found in such bolls (Pl. IX. fig. 1) as were either bored into by the boll-worm, or had been split open by the rot, and did not appear upon the bolls unless they had been previously injured. I have counted as many as thirty of these beetles in a single diseased boll, and there is scarcely an injured or split boll in some fields in which one or more of them is not to be found. They likewise occur in considerable numbers in the tops of such ears of maize as have been eaten out by the corn-worm, (heliothes,) (see Report for 1854,) and have much of the sap exuding, or are covered with a fungoid growth. They appear to dislike light, and seek shelter in dark places, secure from the rays of the sun.

This insect is about the tenth of an inch in length, and of a brown color; the wing-cases are short, covering only about two-thirds of the abdomen. The larva is a small yellow grub, with six fore-legs, and two points at the end of the tail, and is often found in the rotted parts of the bolls.

If this insect were to be found in the bolls before they were already rotted, or to be seen in the act of piercing the outer case, it might, perhaps, with reason, be accused of causing the disease; but, as they are never found inside before the rot has commenced, it is very much to be doubted whether they have anything to do with it, or merely visit such places for the purpose of obtaining a food suitable to their taste, or a dark sheltered place in accordance with their habits.

THE SQUARE-NECKED SYLVANUS.

(*Sylvanus quadricollis.*)

The larva and perfect insect of this minute beetle (Pl. IX. fig. 2) has already been figured, in the Agricultural Report for 1854, where it is described as having been found in Indian corn. It also frequents diseased cotton-bolls, most probably for the sake of the seed, which is generally exposed to its attacks, when the boll has been split open by disease.

ANOTHER INSECT

Was also found very numerous in some of the rotted bolls; but as soon as the latter were taken from the plant and opened, the beetles ran off with great rapidity, and endeavored to hide themselves under any substance that would serve as a place of shelter. They appeared

to dislike the open light, and were generally found in dark and obscure places.

There were likewise several small insects found in rotted-bolls, such as the *Colastus semitectus*, and many others, which it will be unnecessary to enumerate here, as their habits are very much the same as those above mentioned, nearly all of them frequenting such places merely for food and shelter, and not causing the rot in any manner.

The hemipterous insects, heretofore mentioned, certainly do pierce the bolls with their beaks, or piercers, for the sake of the sap; for they have been caught in the very act, and this even before any appearance of the rot could be discovered. They might, therefore, perhaps, with better reason, be suspected of having something more to do with the disease than the small beetles already mentioned. But, even in this case, it would be well to investigate further before coming to a definite conclusion.

THE CORN-WORM.

(*Heliothes?*)

The caterpillar producing this small moth, (Pl. IX. fig. 3,) described in the Agricultural Report for 1854, as injurious to the Indian corn in the Southern States, is likewise found in the bolls of cotton which have been split open by the rot, but can have nothing to do with producing the disease. It most probably feeds upon the seeds contained in the rotted bolls.

The chrysalis is formed in a cocoon inside the boll; it is about one-fifth of an inch in length, of a brown color, and formed in a cocoon of silk, interwoven with fœces and dust from the boll.

The caterpillar is about three-tenths of an inch in length, of a reddish or pink color, with the head and part of the first segment brownish. It has six pectoral, eight ventral, and two anal feet, and is able to suspend itself by a thread, when disturbed. The body is slightly covered with a few short hairs.

The moths appear in about fourteen days, in warm weather, and, when expanded, measure nearly two-fifths of an inch; the upper-wings are of a shaded chestnut-brown, mottled with darker brown and black; the tips of the wings are marked with dark spots; the under-wings are very narrow, brown and deeply fringed with fine hairs, presenting almost the appearance of feathers. The insect, when at rest, places the upper wings together, forming a ridge with the extremity turned up. There appear to be several generations of these insects during the season, and, although found in rotted bolls, they are perfectly harmless as to the causing of disease.

There are several other insects found in rotted bolls which it will be unnecessary here to describe; for, although, as before stated, they are found in bolls already split open by the rot, or eaten into by the worm, yet they are no more the cause of the disease than the woodpecker is the cause of the death of the tree out of which it extracts the insects which have already accomplished its destruction.

THE BOLL-WORM.

(*Heliothes?*)

The egg of the boll-worm moth (Pl. IX. fig. 4) is generally deposited on the outside of the involucel, or outer calyx of the flower, and I have taken it from the outer calyx even of the young boll itself. It has been stated that the egg is laid upon the stem, which also forms the first food of the young worm; but, after a thorough and careful examination of several hundred stems, I found only one egg in this situation, and that, from its being upon its side instead of its base, had evidently been misplaced, and never hatched.

The egg of the boll-worm is laid singly upon the involucel, about twilight, and is of a somewhat oval shape, rather flattened at the top and bottom, and is formed with ridges on the side which meet at the top in one common centre. The color is yellowish until nearly hatched, when it becomes darker, the young enclosed caterpillar showing through the translucent shell. A single boll-worm moth, dissected by Dr. John Gamble, of Tallahassee, contained at least five hundred eggs, which differed much from those of the cotton-caterpillar moth, which are round and flattened like a turnip, of a beautiful green color, and scarcely to be distinguished from the leaf on which they are deposited. The eggs of the boll-worm moth hatched in three or four days after being brought in from the field, and the young worms soon commenced feeding upon the parenchyma, or tender fleshy substance of the calyx, on the outside, near where the egg was laid. When they had gained strength, they pierced through the outer calyx, some through the petals into the enclosed flower-bud, while others penetrated the boll itself. Sometimes the pistil and stamens are found to be distorted and discolored, which is caused by the young worm, when inside the bud, eating the stamens and injuring the pistil, so that it is drawn over to one side. When this is the case, the young worm bores through the bottom of the flower, into the young boll, before the old corolla, pistil, and stamens fall off, leaving the young boll, inner calyx, and outer calyx, or involucel, still adhering to the foot-stalk, with the young worm safe in the growing boll.

The number of buds destroyed by this worm is very great, as they fall off when quite young, and are scarcely observed as they lie, brown and withering, on the ground. The instinct of the caterpillar, however, teaches it to forsake a bud or boll about to fall, and either to seek another, or to fasten itself to a leaf, on which it remains until the skin is shed; it then attacks another bud or boll in a similar manner, until, at length, it acquires size and strength sufficient to enable it to bore into the nearly-matured bolls, which are entirely destroyed by its punctures; for, if the interior is not devoured, the rain penetrates the boll, and the cotton soon becomes rotten and of no value.

The rotted bolls serve also for food and shelter to numerous small insects, such as those already mentioned, and which have been erroneously accused of causing the rot. Whenever a young boll or bud is seen with the involucre, or outer calyx, called by some the "ruffle,"

spread open, it may be safely concluded that it has been attacked by the worm, and will soon fall to the ground and perish. The older bolls, however, remain on the plant; and, if many of the fallen buds or bolls be closely examined, the greater portion of them will be found to have been previously pierced by the worm, the few exceptions being caused either by the minute punctures of some of the plant-bugs, from rain, or other atmospheric influences. Those injured by the worm can be distinguished by a small hole on the outside where it entered, and which, when cut open, will generally be found partially filled with small fragments of fœces.

When very young, the boll-worm is able to suspend itself by a thread, if blown or brushed from the boll or leaf on which it rested. After changing its skin several times, and attaining its full size, the caterpillar descends into the ground, where it makes a silky cocoon, interwoven with particles of gravel and earth, in which it changes into a bright chestnut-brown chrysalis. The worms, which entered the ground in September and October, appeared as perfect moths about the end of November.

A boll-worm, which was bred from an egg found upon the involucel, or ruffle of the flower-bud, grew to rather more than a twentieth of an inch in length by the third day, when it shed its skin, having eaten in the meantime nothing but the parenchyma, or tender, fleshy substance from the outside. On the fifth day, it bored or pierced through the outer calyx, and commenced feeding upon the inner; and, on the sixth day, it again shed its skin, and had increased to about the tenth of an inch in length. On the tenth day, it again shed its skin, ate the interior of the young flower-bud, and had grown much larger. On the fourteenth day, it, for the fifth time, shed its skin, attacked and ate into a young boll, and had increased to thirteen-twentieths of an inch in length. From this time, it ate nothing but the inside of the boll, and on the twentieth day the skin was again shed, and it had grown to the length of an inch and one-tenth, but unfortunately died before completing its final change.

These moths probably lay their eggs on some other plants when the cotton is inaccessible, as a young boll-worm was found this season in the corolla of the flower of a squash, devouring the pistils and stamens; and, as there is a striking similarity between the boll-worm and the corn-worm moth, described in the Agricultural Report for 1854, in the appearance, food and habits, alike in the caterpillar, chrysalis, and perfect state, it will perhaps prove that the boll-worm may be the young of the corn-worm moth, and that the eggs are deposited on the young boll, as the nearest substitute for green corn, and placed upon them only when the corn has become too old and hard for their food.

Colonel B. A. Sorsby, of Columbus, in Georgia, has bred both these insects, and declares them to be the same; and, moreover, when, according to his advice, the corn was carefully wormed on two or three plantations, the boll-worms did not make their appearance that season on the cotton, notwithstanding that, on neighboring plantations, they committed great ravages.

The worms, or caterpillars, have six pectoral, eight, ventral and

two anal feet, and creep along with a gradual motion, quite unlike the looping gait of the true cotton-caterpillar, and vary much in color and markings, some being brown, while others are almost green. All are more or less spotted with black, and slightly covered with short hairs. These variations of color may perhaps be caused by the food of the caterpillar. Some planters assert that, in the earlier part of the season, the green worms are found in the greatest number, while the dark brown are seen later in the fall, as we know is the case with the cotton-caterpillar.

The upper-wings of the moth are yellowish, in some specimens having a shade of green, but in others of red. There is an irregular dark band running across the wing, about an eighth of an inch from the margin, and a crescent-shaped dark spot near the centre; several dark spots, each enclosing a white mark, are also discovered on the margin; the under-wings are lighter colored, with a broad, black border on the margin, and are also veined distinctly with the same color. In the black border, however, there is a brownish-yellow spot, of the same color as the rest of the under-wings, which is more distinct in some specimens than in others, but may always be plainly perceived; there is also, in most specimens, a black mark or line in the middle of the under-wings, on the nervure; but, in some, it is very indistinct.

These moths multiply very rapidly; for, as I have before observed, one female moth sometimes contains five hundred eggs, which, if hatched in safety, would rapidly infest a whole field, three generations being produced in the course of a year.

In an interesting communication from Colonel Benjamin F. Whitner, of Tallahassee, he states that the boll-worm was scarcely known in his neighborhood before the year 1841; and yet, in the short period of fourteen years, it had increased to such a degree as to have become one of the greatest enemies to the cotton on several plantations in that vicinity.

It has been recommended to light fires in various parts of the plantations, at the season when the first moths of this insect make their appearance, as they are attracted by light, and perish in great numbers in the flames; and, if the first brood of females be thus destroyed, their numbers must necessarily be reduced, as it is highly probable that it is the second and third generations which do the principle damage to the crops. Some successful experiments in killing these moths with molasses and vinegar were made by Captain Sorsby, a year or two ago, which I here describe in his own words:

"We procured eighteen common-sized dinner-plates, into each of which we put about half a gill of vinegar and molasses, previously prepared in the proportion of four parts of the former to one of the latter. These plates were set on small stakes, or poles, driven into the ground in the cotton-fields, one to about each three acres, and reaching a little above the cotton-plant, with a six-inch-square board tacked on the top, to receive the plate. These arrangements were made in the evening, soon after the flies had made their appearance. The next morning we found from eighteen to thirty-five moths to each plate. The experiment was continued for five or six days, distribut-

ing the plates over the entire field, each day's success decreasing until the number was reduced to two or three to each plate, when it was abandoned as being no longer worthy of the trouble. The crop that year was but very little injured by the boll-worm. The flies were caught, in their eagerness to feed upon the mixture, by alighting into it, and being unable to make their escape. They were doubtless attracted by the odor of the preparation, the vinegar probably being an important agent in the matter. As flies feed only at night, the plates should be visited late every evening, the insects taken out, and the vessels replenished, as circumstances may require. I have tried the experiment with results equally satisfactory, and shall continue it until a better one is adopted." It might be well also to try the lantern-trap before mentioned, as another means of destruction, and, likewise, the method of poisoning recommended in the general remarks on insects. As it appears from Colonel Sorsby's communication that the moth is attracted by, and feeds with avidity upon molasses and vinegar, could not some tasteless and effective poison be mixed with this liquid, so that all the early moths which might partake of it would be destroyed before laying their eggs?

A long caterpillar, (Pl. IX. fig. 5,) measuring from an inch and three-fifths to an inch and nine-tenths in length, and with a thick body, is sometimes found in bolls of cotton in similar situations as the boll-worm. It feeds likewise upon the leaf, and some specimens, which were confined in a box, devoured green corn from the ear. These insects vary much in color, some being of a beautiful velvet-black, while others are considerably lighter. The head of the caterpillar appears small for the bulky size of the body, and is black, with two stripes of yellow, forming an angle on the front. On each side of the back runs a longitudinal line, and below the spiracles is seen another line of a reddish or ruddy color. The under part is of a light-brown. It has six pectoral, eight ventral, and two anal legs, and its mode of progression is by a gradual creeping, the same as the boll-worm.

The chrysalides were formed under ground, in cocoons of earth, agglutinated with silk, and were about four-fifths of an inch in length, and of a brownish color.

The moth measured an inch and three-tenths across the expanded wings; the upper pair were of a brownish color, marked on the margin with an irregular band of dirty cream-color, marked with black spots on the extreme outer edge. In the centre of each wing was an oblique line of the same color; the body was brown; the under-wings of a dirty, yellowish-white, with a dark shade near where they touch the upper-wings; the antennæ were threadlike.

The eggs producing these worms were found deposited in clusters in September, and not singly, like those of the boll-worm. The old caterpillars are subject to a disease which often proves fatal; and hence it is difficult to raise them in confinement. When attacked, they appear to bloat or swell very much, become full of a watery pulp, suddenly cease to feed, and soon perish, when the outer skin turns black, and the inside is found to be full of a liquid, putrid matter. Perhaps, if they were not subject to this disease, these cater-

pillars might do as much damage to the cotton as the boll-worm; but, being generally not very numerous, they cannot do much injury.

The same remedies will do for these worms, or caterpillars, that have been recommended for the boll-worm.

THE STRIPED PALE-GREEN CATERPILLAR.

There was another caterpillar (Pl. IX. fig. 6) found feeding upon the leaves of the cotton-plant, near Columbus, in Georgia, which sometimes buried itself in the bolls, in the same manner as the boll-worm. It was about an inch and a half in length, of a pale-green color, with wavy, longitudinal stripes of a lighter color on the back, and with a longitudinal black line running down each side, thicker and darker on the fore part of the head. Under this was a broader line, nearly white, tinged with light-red or reddish-brown. On each side of every segment was a small black spot. It had six pectoral, eight ventral, and two anal feet.

Most of these caterpillars were found about the 20th of October, but, unfortunately, died before completing their final change. They were not numerous on the plantations, and therefore could do but little damage.

THE RED-BUG, OR COTTON-STAINER.

(*Lygœus?*)

This destructive insect is found by millions in East Florida, on the cotton plantations, where it does immense damage by staining the fibre of the cotton in the bolls, and rendering it unfit for use where pure-white fabrics are required. The specimens figured (Pl. IX. fig. 7) were found near Jacksonville, in October, on the open bolls, under the dried calyx, and congregating together on the dead leaves under the plants, or on rotten logs, or decayed wood. Several of the open bolls were actually red with these insects, exhibiting every stage of growth, from the larva to the perfect bug, all clustered together in such masses as almost to hide the white of the cotton itself. The beak, or rostrum, is four-jointed, with the end blackish, and, when not in use, is re-curved under the thorax, which is somewhat triangular in shape, with the anterior part red; a narrow, distinct band of whitish-yellow divides the thorax from the head; the posterior part is black, edged between the thorax and wing-cases with whitish-yellow; the scutellum is triangular, red, and edged with a distinct line of whitish-yellow on each side, and partly down the centre of the wing-case; the elytræ, or wing-cases, are flat, brownish-black, and containing two distinct x-shaped whitish-yellow lines on them, interseeting each other near the centre; the wing-cases are also edged with a distinct yellowish-line, as far as the x. The body is flattened, and, in the female, projects on each side beyond the wing-cases, showing the bright-red of the abdomen, and contrasting with the dark color of the wing-cases. The under-wings, are hidden under the upper wing-cases, and are transparent, veined, and of a yellowish color, clouded

with black. The thighs of the fore-legs are somewhat spiny near the tibiæ, and of a red color. The tibiæ and tarsi are black; the under part of the body is bright-red, with rings of yellowish-white running around it, on the edge of each segment.

The female produces about one hundred eggs; the young larva is completely red, almost scarlet, with distinct whitish-yellow bands around the body, on the edge of each segment. The thighs are red, with the tibiæ, tarsi, and antennæ blackish.

The pupa differs only in size, and in having the unformed wing-cases very small and black, contrasting strongly with the vivid red of the body.

The perfect male is about three-fifths of an inch in length, and the female about seven-tenths of an inch, from the head to the end of the abdomen. They are similar in shape and color, differing only in size. The head and eyes are red, the antennæ black, with four long joints.

The following communication on the subject of this insect was received from Mr. B. Hopkins, of Jacksonville, a practical Sea-Island planter, of nearly thirty years experience:—

"The 'red-bugs,' or, as they are sometimes properly denominated, the 'cotton-stainers,' generally make their appearance about August, or late in July, which is near the usual season for cotton to begin to open. They can readily be distinguished from other bugs, harmless in their nature, by their being of a red color, and more sluggish in their movements. The nearer the fruit advances towards maturity, the more injury they do to the cotton. The pod, or boll, is perforated by this bug. Whether the staining matter is imparted to the fibre of the cotton during the perforation directly, or by a slow process diffusing itself with the sap abounding at that time in the pod, is not yet ascertained. I am of the latter opinion, from the fact that almost the entire product of the boll is discolored when it opens, which does not seem at all to cause a premature development. As winter approaches, they gradually retire, and take refuge among the logs, or burrow into the soil at the root of the cotton-plant, where they hybernate. After a wet season, in winter, they may be found in hundreds on the sunny side of the stalks, enjoying the genial atmosphere, until towards evening, when they again retire. They can be kept down very easily, when there are not more than five acres planted to the hand.

"I have been in the habit of offering a reward every night to the negro that brings in the greatest quantity, each of whom is furnished with a pint bottle suspended across the shoulders, into which, as they pass along picking the cotton, they deposit all they can discover. In many instances, I have seen the bottle filled by one negro in a day. They may also be greatly reduced, by destroying them when they come out in winter, in their half-torpid state; a torch of fire in that case is best. They may be buried a foot under ground, and most of them will still escape from their inhumation. If there should be stumps or trees in the fields, they should be burned, and that will generally reduce the quantity for a year or more. In fact, when they receive timely and proper attention, they need not be dreaded.

"No process that I know of can extract the stain produced in the

bolls; it is indelible, and considerably reduces the price of the cotton in the market. These insects have been much on the increase for the last ten years, which I attribute to the excess in planting, as well as the want of proper efforts for their destruction."

It has been stated by other planters, that the fœces of the insect produces the reddish or greenish stain, and that the red-bugs will collect where there are splinters or fragments of sugar-cane. Advantage has already been taken of this habit to collect them by means of small chips of sugar-cane, when they may be destroyed by boiling water; and as they also collect around piles of cotton-seed, they may thus be easily decoyed, and then killed, either by fire or hot water, when congregated. All stumps and dead trees standing in the field should be well burnt out. The experiment of destroying them by means of the crushed sugar-cane and poison, has been tried; but, as no report of the experiment has been received, it remains doubtful whether it can be recommended or not.

INSECTS FOUND IN THE COTTON-FIELDS—NOT INJURIOUS TO THE CROP.

(*Zanthidia niceppe.*)

There are many other insects found in cotton-fields, which are perfectly harmless to the plant, although the larvæ of many of them subsist upon the weeds which grow between the rows or around the edges of the plantation.

Among these insects, we find butterflies, in general, one species of which is frequently seen hanging over the ground by hundreds, around moist and damp places. The caterpillar of this fly (Pl. IX. fig. 8) is of a deep-green, velvety appearance, with a yellowish longitudinal line running down each side. It was found upon the *Cassia marylandica*, and measured an inch and one-fifth in length. The chrysalis is greenish, with a very pointed head, and fastened to the branch or leaf by the tail, and by a thread fastened at each side and passed over its back.

This butterfly is about an inch and four-fifths across the expanded wings, which are of an orange-color, with a broad, black border around the edges.

THE ARGYNNIS COLUMBINA.

The caterpillar of another butterfly (Pl. IX. fig. 9) is often found on cotton-plants, where it has wandered from its natural food, which consists of the wild passion-flower, so often found growing as a weed amongst the crops. It is about an inch and two-fifths in length, of a bright-chesnut color, with two longitudinal black stripes along the sides, and a broken line of yellowish-white inside of each black stripe; it has also two long, projecting, black horns, or protuberances,

on the first segment of the body. When about to change, it selects a place under a leaf, branch, or fence, where it spins a small spot of silk, to which it suspends itself by its hind-legs; the skin of the fore part of the body then splits open, and the chrysalis makes its appearance, also hanging suspended by means of several small hooks, with which the end of the tail is furnished, and which, during the disengagement of the skin, becomes entangled in the silk.

The chrysalis is about seven-tenths of an inch in length, of a pale, whitish-green, containing black marks and brilliant metallic, golden spots. These chrysalides, however, together with those of the great American frittellary butterfly, are often destroyed by the larvæ of a small fly.

The butterfly makes its appearance in summer in a few days, and measures from two inches and a half to three inches across the expanded wings. It is of a bright chesnut-brown, barred and spotted with black.

GREAT AMERICAN FRITTELLARY

(*Agraulis vanillæ.*)

The caterpillar (Pl. IX. fig. 10) of this butterfly is of a light chestnut-brown color, with a dark, longitudinal stripe down each side, and is shaded with black below the spiracles. It measures about an inch and a half in length, and is covered with sharp, thorny spines; two spines are also found upon the top of its somewhat square-shaped head.

The chrysalis, which is shaded with brown and drab, is about an inch and a tenth in length, and hangs suspended by the tail from trees, shrubs, and fences.

The butterfly measures from two inches and three-fourths to three inches and a fourth across the wings; the upper sides of which are of a bright rich chesnut-brown, spotted and marked on the veins with black. The under-side is beautifully marked with large, metallic, silver spots.

ANTS.

Whenever the plants are infested with cotton-lice, (aphides,) myriads of small ants may be seen running hurriedly up and down the stems and leaves, or leisurely moving amongst the lice, quietly tapping first one and then another with their antennæ, or feelers, and occasionally making a dead halt where they find a sufficiency of this insect food. Many planters suppose that these ants are the parents of the lice; others again suspect them of destroying the aphis; neither of which, however, is the case, as the ants merely visit the colonies of lice to devour the sweet, gummy substance that exudes from the tubercles on the bodies of the aphides, and which is commonly called "honey-dew," from the erroneous impression that it is formed in the atmosphere, and then deposited in the form of dew upon the upper surface of leaves. This honey-dew, however, is a sweet liquid, ejected from the anal tubercles of the cotton-louse, and elaborated in its own body, from the sap which had previously been

extracted from leaves or young shoots, and which, if not immediately devoured by the ants, is ejected by the plant-louse, and falls in drops upon the upper portions of the leaves that are beneath, making them appear as if varnished, or, if old, causing the places thus defiled to be black and rusty, as if affected with a black mildew, or rust.

The ants feed voraciously upon this honey-dew, when fresh, and cause the aphides to eject the substance at will, by merely tapping their abdomens with their antennæ; the drop ejected is immediately devoured by the ants, and other aphides are visited and subjected to the same treatment, until the appetites of the ants are satisfied, when they either loiter about the leaves or descend to their nests in the ground. Ants are of utility in devouring any weak or disabled insects they may encounter in their path, or in consuming any animal substances which might otherwise contaminate the air.

Ants are generally divided into "males," "females," and "neuters." The males and females, at one stage of their growth, are furnished with wings, which the female gnaws or casts off when about to form a colony. The neuters afterwards form the general mass. There are several varieties of the ant found in the cotton-fields, of very different habits and appearance. The most numerous make a hole in the earth, and form a sort of hillock around it, of the grains of earth or sand brought up from below the surface of the ground, and from this nest they make excursions in every direction in search of food.

There is also another species: "red ants," so called, but in reality belonging to the family mutillidæ. They are found singly upon the ground in plantations, and sometimes measure half an inch in length. Their color is a vivid, velvety-red and black. They are able to inflict painful and severe wounds with a long sting with which they are provided. There are also three or four species of small ants, exceedingly troublesome in some of the Southern houses, where they find their way into pantries, closets, boxes or trunks, however closed, and devour any eatable article which may fall in their way. The only means of preventing the ravages of these insects is to isolate the article to be preserved in a vessel of water, or to put all four of the legs of the table, on which the articles may be placed, into vessels filled with water.

The smaller ants, however, have a formidable enemy, the ant-lion, which, in the larva state, forms a funnel-shaped hole in the sand, near the ants' nests, in the bottom of which it lies concealed, all except its jaws, and waits with patience in this den for any ant that may chance to pass along the treacherous path. The ant, suspecting no harm, reaches the edge of the pit-fall, and, the loose sand giving way, it is precipitated to the bottom, where the larva of the ant-lion immediately seizes it with its jaws, and, after sucking out its juice, casts the empty skin away. Should the unfortunate ant, however, elude the first assault of the ant-lion, and endeavor to escape by climbing up the steep sides of the funnel-shaped hole, the ant-lion throws repeated showers of sand with such precision upon the unfortunate victim that it very seldom fails to overwhelm and bring it within reach of its jaws, when it is seized and its juices extracted as above described.

The perfect insect of the ant-lion much resembles the dragon-fly in form and general appearance; it is also furnished with four veined wings, by means of which it is enabled to transport itself from place to place. The antennæ, however, are much longer, and the larvæ of the dragon-fly are decidedly aquatic, instead of living upon the land, like those of the ant-lion.

INSECTS BENEFICIAL TO COTTON

SPIDERS.

Spiders, in cotton or grain-fields, are decidedly beneficial, inasmuch as they wage perpetual war against other insects, and are incessantly on the watch to catch and destroy all which, in their erratic flights, happen to become entangled in their webs.

One spider makes a very singular nest for her young, of fine silk, webbed up and closely woven together in the shape of a basket with a round bottom, and most generally placed on or near the top of the cotton-plant. This basket is furnished with a cover fitting closely to the top, and is filled with eggs. When the young spiders are hatched, they creep from under this cover, and eventually disperse over the web, which is comparatively large and strong, and stretched from plant to plant. The old female spider appears to brood over this nest, displaying much maternal solicitude for the safety of her infant progeny; for, if forced away, she immediately returns, and will suffer herself almost to be torn limb from limb, rather than desert her precious charge.

The habits of the different species of spiders are very dissimilar; for, while some are almost entirely stationary all their life-time, others are continually moving about, roaming from leaf to leaf, and living entirely by hunting. Many spin their nets from plant to plant, to entrap unwary insects, and generally stay quietly at home in comfortable webs, securely sheltered from the sun and rain, under or between the leaves, waiting patiently for every stray moth that is so unfortunate as to fly into their nets. With the fore-feet carefully placed on a line leading to the radiating net-work, in order to feel the tremulous motion imparted to it by the unavailing efforts of any captive insect to escape, the ant remains perfectly motionless until some straggling fly happens to become entangled, when it immediately rushes down the central line, and, after tying the limbs of its unfortunate victim with a loose web of silk, in order to arrest its struggles for life, deliberately gives it the death-wound, drags the carcass to its den, and devours it at leisure. Other spiders hunt for and capture their insect prey in a manner similar to that practised by the cat. One of them at first approaches an unconscious victim so gently as not to awaken its suspicion, at the same time taking advantage of every inequality of stem or leaf, in order to conceal itself, until within springing distance, and then, jumping suddenly upon its back, killing it with its powerful hooked fangs. It then sucks out

the whole of its juices, leaving only the empty skin, to be blown away by the wind.

Another description of a small spider, about the tenth of an inch in length, of a light-drab color, with two or more dark spots on its back, was found very numerous inside of the involucre, or ruffle, of the cotton-bloom, bud, and boll, where it is said to be useful to the planter in destroying very young boll-worms. In many cases, where the eggs of the boll-worm moth had been deposited and hatched out, and the young worms had eaten through the outer calyx, and already partially pierced a hole in the young bud, or boll, it was frequently observed that no worm could be discovered inside; but upon opening such a ruffle, this small spider was almost invariably found snugly ensconced in its web; hence it was surmised that the young worm had entered between the ruffle and the boll, or bud, and had been destroyed by the spider, the nest of which was found in such situations.

As all spiders are in the habit of destroying small, noxious insects, they may be regarded as beneficial, especially when the crops are preyed upon by the larvæ of very small flies, such as the wheat midge, the Hessian-fly, and many others. These insects, being constantly on the wing, flying about from plant to plant, to deposit their eggs, are very apt to become entangled in the webs, and to be there destroyed.

The spider itself, however, has enemies, one of which is the "mud-wasp," so called. This insect builds cells of clay in out-houses, and under beams, or in other sheltered places. Their nests resemble small pieces of mud thrown up against a roof or wall, when wet, and afterwards dried by exposure to the air.

THE CAROLINA TIGER-BEETLE.

(*Megacephela carolina.*)

This beetle (Pl. X. fig. 1) belongs to the family, cicindeladæ, otherwise called "tiger-beetles," from their savage propensities, and the beautiful spots and stripes with which their metallic wing-cases are adorned. These beetles are always hunting about the ground in search of insect food. A smaller and darker species especially delights in the glare and heat of the mid-day sun; and, when disturbed, flies only a short distance, alighting with its head directed towards the object which has excited its alarm.

The larvæ of the tiger-beetle inhabits cylindrical holes in the earth, and, in these burrows, they wait patiently for any passing insect that may be crawling about on the ground, which, when within reach, is seized, dragged to the bottom of its subterranean den, and there devoured at leisure. They are of a dirty-yellowish-white, and are furnished with two hooks on the back. In the Southern States, they are often taken by the boys, by means of a piece of grass or straw, which being inserted into their dens, is seized by the insect in its crooked jaws, and held with such tenacity that it will not let go until, by means of a sudden jerk, it is brought to the surface of the ground and secured.

The Carolina tiger-beetle is about seven-tenths of an inch in length, of a most beautiful metallic blue, violet, and green; and, when placed in certain positions, it assumes the lustre of bronze or gold. It may also be known by a yellowish curved spot on the extremity of each wing-case. It appears not to be so partial to the light of the sun as some other species, but often conceals itself under stones. It is also seen much more frequently in the cotton-fields during cloudy weather, or toward evening, than in a fervid mid-day sun.

THE PREDATORY BEETLE.

(*Harpalus?*)

A beetle (Pl. X. fig. 2,) belonging to the genus harpalus, is very beneficial to the cotton-planter, inasmuch as its food consists principally of other insects, and of dead putrescent substances. Numbers of them may be seen running about the surface of the ground in search of food, and when disturbed, hide themselves under grass, roots, or stones. The formation of their jaws is peculiarly adapted to a predatory life. As they are very strong, and hooked at the extremity, they are enabled to seize and hold fast any soft-bodied insect, which they generally kill and devour.

It should here be mentioned, however, that the larvæ of an insect of this species has been accused in Europe of feeding upon the pith and stems of grasses and succulent roots, but at the same time it is stated to feed also upon the larvæ of other insects.

Another very similar insect, (*Zabrus gibbus,*) both in the larva and pupa state, is said to be injurious to wheat in Europe; and although the two last mentioned may be injurious to vegetation, yet, as a general rule, the carabidæ are carniverous, and destroy multitudes of insects, in the larva, pupa, and perfect state.

THE DEVIL'S COACH-HORSE.

(*Reduvius novenarius.*)

This insect abounds (Pl. X. fig. 3) in the city of Washington, during the summer and autumnal months, and is very useful in destroying the disgusting caterpillars which swarm on the shade-trees. The eggs are deposited in autumn upon branches, and are hatched in May or June. When young, the insects have abdomens of a bright-red color, with some dark or black spots on their backs. The head and thorax are black. When they shed their skins, they are greyish in color, and display only the rudiments of wings. It is only in the last stage that they acquire perfect wings, when they are capable of flying with great vigor.

The perfect insect measures about an inch and a quarter in length. It destroys multitudes of noxious insects, in every stage of their growth, and is therefore highly beneficial; but, at the same time, it is dangerous to man, if handled incautiously, as the punctures made by its piercer are often followed by severe consequences. When about to attack another insect, it advances towards its prey with a

most cautious and stealthy gait, lifting up and putting down its feet apparently in the same careful manner as a pointer when approaching his game. When near enough to make the fatal dart, it plunges its piercer into the unfortunate caterpillar, and deliberately sucks out its juices. A small specimen experimented with, was placed in a box with ten caterpillars, all of which it destroyed in the space of five hours.

THE ICHNEUMON FLY.

(*Ichneumon?*)

An ichneumon-fly (Pl. X. fig. 4) was found in the cotton-fields near Columbus, in Georgia, busily employed in search of some caterpillar in the body of which to deposit its eggs, as is generally the habit of this class of flies. The eggs being hatched within the caterpillar, the larvæ devour the fatty substance, carefully avoiding all the vital parts, until they are fully grown, when the caterpillar, having in the mean time changed into a chrysalis, with the devouring larvæ in its interior, the life of its unresisting victim is destroyed, and the grubs change into pupæ, and eventually emerge from the chrysalis skin, perfect ichneumon-flies, to deposit their eggs in other caterpillars.

These insects are generally seen running about plants infested with caterpillars or worms, continually jerking their wings, and anxiously searching in every cranny and crevice in quest of a subject, in which to form the nest and provide food for their young.

The circumstance of this fly's coming from the skin, or case of the moth, or butterfly, is the cause of the mistakes so often made by persons not well versed in natural history; for, when a caterpillar is confined in a glass, and after the change to a chrysalis has taken place, when the real moth is expected to come out, and this fly makes its appearance, the young naturalist concludes, of course, that the fly is produced by the caterpillar; whereas, the rightful tenant of the chrysalis-case had been previously displaced and devoured by the larva of the ichneumon-fly, which was produced from an egg placed by the parent fly in the body of the caterpillar. This fact is here noticed in consequence of some drawings of insects injurious to cotton having been sent to the Patent Office, among which an ichneumon-fly was figured as proceeding from the chrysalis of a caterpillar. This was correct, inasmuch as it was the parasite which had devoured the chrysalis, but not true, when intended to represent the perfect insect as naturally proceeding from the caterpillar itself.

Some chrysalides of the cotton-caterpillar, which had been preserved during the autumn of 1855, as an experiment to try whether they would live until the following spring, having been hatched out prematurely by the heat of the room in which they were kept, two ichneumon-flies were produced of a slender shape, and about half an inch in length; the abdomen, or body, of the female, was black, and marked with seven light-colored, yellowish, narrow rings around it; the head was black; with the eyes brown, the antennæ long, jointed,

and nearly black; on the head were three ocelli; the thorax was black; the wings transparent, of a rather yellowish tinge, veined with black, and having a distinct black mark on the outer margin of the upper pair; the first joint of the hind-leg was comparatively large, thick, and of a brownish color; the thighs were also brown; the tibiæ, black, with a broad white band in the middle; the tarsi were white, tipped with black; and the ovipositor protruded more than the tenth of an inch. The male presented much the same appearance as the female, but was more slender in form.

THE SMALLER ICHNEUMON-FLY.

(*Ichneumon?*)

The ichneumon-fly, which destroys the aphis, or louse, so very injurious to the cotton-plant, is a minute insect, not quite the twentieth of an inch in length. The head and thorax are black, and the legs and abdomen of a yellowish color. Although so extremely small as to be unobserved, it is constantly engaged in exterminating the cotton-lice, myriads of which it destroys by preying upon their vitals. The female fly lays a single egg in the body of each louse, which, when hatched, becomes a grub. This grub devours the interior substance of the aphis, leaving only the grey and bloated skin clinging to the leaf. This skin serves the young larva for a shelter, where it remains until it changes into the perfect fly, when it emerges from a hole gnawed through the back, and issues forth furnished with four transparent wings, to recommence the beneficial labor of depositing more eggs in the surrounding colonies of lice on the neighboring plants.

The number of lice destroyed in this way can be more fully appreciated by observing the multitude of empty grey and bloated skins, more or less scattered over the cotton-plants infested, each skin having a hole in the back through which the perfect fly has escaped.

THE SYRPHUS.

The larvæ of this syrphus (Pl. X. fig. 5) are found wherever aphides, or plant-lice, abound, and present the appearance of small, yellowish-white naked maggots, or grubs, of about a fifth of an inch in length. Their color is brown, with six distinct yellow spots on the first three segments of the body, and the sides are also marked on the margin with yellow; the body is somewhat hairy. The head is armed with powerful jaws, and gradually tapers to a point, while the tail terminates abruptly as if cut off.

The parent fly deposits her eggs amongst the lice, in order to insure an adequate supply of food to each grub. These eggs are soon hatched by the heat of the sun, and the young grub immediately commences crawling about the leaf; and, being blind, incessantly gropes and feels around on either side in search of cotton or plant-lice, its natural food, one of which, being found by the touch, is instantly seized, elevated above the surface of the leaf on which it

is quietly feeding, in order to prevent the struggling victim from using its feet, or clinging to the leaf when endeavoring to escape from its voracious destroyer. After piercing the living insect, the grub leisurely sucks out the juices, throws away the empty skin, and recommences feeling about in search of another, which, when found, is treated in the same way. When ready to change, the syrphus maggot fastens itself to a leaf or stalk, by means of a glutinous secretion from its own body, and, the outer skin contracting into a pear-shaped case, soon hardens by exposure to the air, and the pupa is formed inside.

After a few days, during the heat of summer, the perfect fly emerges from a hole, at the blunt end of the case, to lay eggs amongst the colonies of lice on the neighboring plants. The perfect fly is about seven-tenths of an inch across the wings, which are two in number, and transparent. The body is generally more or less banded with brown, or black and yellow, and appears like that of a diminutive wasp. This fly has a peculiar habit of hovering on the wing, apparently without motion or exertion, during the heat of the day, near or over flowers, and when disturbed it darts away with great swiftness; but, if the object that alarmed it is removed, it immediately resumes the same attitude and spot, only darting off every now and then to chase some other intruding fly from its own peculiar domain, over which it appears to imagine it possesses absolute sway.

These insects are of essential aid to the farmers and planters, as their larvæ materially diminish the numbers of lice which infest vegetation.

THE LADY-BIRD.

(*Coccinella?*)

The lady-bird (Pl. X. fig. 6) is a most valuable auxiliary to the cotton-planter, as it destroys the cotton-louse, or aphis, by thousands, and is most plentiful where they abound, always being busy at the work of destroying them; and, as such, I consider it one of the most beneficial of insects to the planter.

The larva is a small, bluish-black, alligator-looking insect, of about the fourth of an inch in length, spotted with a few orange marks on the sides and back. Whenever one of them is seen among a colony of the aphides, the planter may safely calculate that in a few days the number of the lice will be greatly diminished. The larva, when hungry, seizes an aphis, and immediately commences eating him alive. This savory repast being finished, it eagerly hunts about until it has secured another victim, and thus completely destroys all the others upon the leaf. When about to change into the pupa, it fastens itself by the tail to a leaf; the skin of the back splitting open, a small hump-backed, black and orange-colored pupa makes its appearance, which, although furnished with the rudiments of wings and legs, is incapable of locomotion or feeding, but remains adhering to the leaf, with the dried-up skin of the larva still sticking to the end of the pupa. After remaining in this state for a few days, this skin

again splits, and the perfect lady-bird emerges, furnished at first with soft wings, but which afterwards harden, and serve to transport it to the distant colonies of cotton-lice, in the midst of which the eggs are again deposited, to form new broods for the destruction of the planters' greatest pest. The perfect lady-bird also devours aphides, but not in such numbers as their larvæ, in which state it also destroys the chrysalis of the butterfly, (*Argynnis columbina*,) seen so often in the cotton-fields. I have repeatedly observed them in Georgia killing the chrysalides of this butterfly, which hung suspended from the fence-rails, and on the under side of the boughs of trees and shrubs. It appears to attack the chrysalis chiefly when soft, and just emerged from the caterpillar-skin. It is in this state that these wandering larvæ attack it, and, biting a hole in the skin, feed greedily upon the green juice which exudes from the wound. Sometimes, however, it becomes a victim to its own rapacity; for the juice of the chrysalis, drying up by the heat of the sun, quickly forms an adhesive substance, in which the larva is caught, and thus detained until it perishes. Indeed, so very voracious are these larvæ, that they will even devour the defenceless pupæ of their own species, when found adhering to fences or walls.

Many planters imagine that these lady-birds are in some mysterious manner connected with the appearance of the cotton-louse, or even that they are the progenitors of the aphis itself. This erroneous impression is formed in consequence of these insects being always found in similar situations at the same time, and abounding on plants already weakened by the attacks of the cotton-louse. Their sudden disappearance is also accounted for, as, with the decrease of their natural food, the lady-birds also disappear and migrate to neighboring plantations, in search of a fresh supply of nutriment. I have actually known several planters who have caused them to be destroyed by their field hands, when and wherever found, and who complained that their plants were still destroyed by the aphis, or cotton-louse. This was only to be expected, as they had destroyed the natural enemy of the louse, and suffered the pests themselves to breed in peace and safety. I have seen the larvæ of the lady-bird as late as the 18th of November, in Georgia, still busy exterminating the aphis. The yellow, oleaginous fluid, which is emitted by this insect when handled, has a powerful and disagreeable odor, and is mentioned by Westwood, in his "Modern Classification of Insects," as having been recommended as a specific for the tooth-ache.

It may be remarked, however, that there is a much larger species of this insect which does considerable damage to the leaves of cucumbers, melons, squashes, &c., as both larvæ and perfect insects devour the leaves and eat holes in them, so as sometimes totally to disfigure and destroy the plants.

The perfect insect measures nearly half an inch in length, and is of a yellow color, with twelve large and small black spots on the wing-cases, and four small black spots on the thorax; it can be very easily distinguished, however, from its beneficial congener, both by size and color, the useful lady-bird being only about the sixth or the seventh of an inch in length, and of a bright-red, or almost scarlet

color, with black spots, while the injurious insect is much larger, measuring nearly half an inch in length, and being of a light-yellow color, spotted with black.

THE LACE-WING FLY.

(*Hemerobius?*)

The larva of the lace-wing fly (Pl. X. fig. 7) is furnished with two long and sharp jaws, by means of which it seizes the cotton-louse, and in a few minutes sucks out the juices, leaving merely the white, dried skins, to show where it once commits its ravages. The eggs are very singularly placed at the end of a thread-like filament, fastened to the under side of the leaf, and are generally deposited near a colony of lice, in clusters of a dozen or more together, causing them to appear to the casual observer like a bunch of fungi. The eggs being hatched in the midst of the cotton-lice, the young larvæ commence their work of extermination, seizing the younger lice in their jaws, and holding them in the air, and in despite of their struggles, sucking out the juices, and finally throwing away the empty skins.

The larvæ of this insect are not quite a fifth of an inch in length, and are furnished with a sort of apparatus at the extremity of their tails by means of which they are capable of adhering to a leaf, even when all their feet are detached, thus being guarded against accidental falls during high winds, that might otherwise destroy them. When ready to change, a thread is spun from the tail, and, often forming a rough sort of cob-web, the insect spins a semi-transparent, ovoid cocoon, from which it emerges as a beautiful, bright-green fly, with two brilliant eyes, which sparkle like gold, and four transparent wings, of a greenish cast, delicately veined, and netted with nerves resembling the most beautiful lace-work; and hence the common name. This splendid insect, however, emits a most nauseous and fetid odor when held in the hand.

INSECTS INJURIOUS AND BENEFICIAL TO THE ORANGE-TREE.

THE ORANGE-SCALE.

(*Coccus?*)

The insect which has been so destructive to the once flourishing orange-groves of Florida presents the appearance of a minute, narrow, elongated scale, (Pl. X. fig. 8,) with a narrow, semi-transparent, whitish margin. That of the female resembles one of the valves of a long muscle-shell, in shape, and adheres closely to the leaf or branch on which it is fixed, and is apparently formed by successive semi-circular layers added from time to time. When fully grown, it measures about the tenth of an inch in length, by about the fortieth part of an inch in breadth, at the broadest part.

The young insects are produced from eggs deposited by the female under the broader end of the outer case, or shell; and, when first hatched, are furnished with six legs, by means of which they escape from under the maternal shelter, which is somewhat elevated from the leaf, at the hinder part, to allow the egress of the young, which are extremely small, and appear in numbers, like minute, yellowish specks upon the leaf; but, if magnified, the six legs, two antennæ, and two short bristles, at the end of the abdomen, can be plainly distinguished. The body is of a pale-yellowish color, and divided into segments.

When tired of rambling, and having arrived at a suitable place for feeding, the cocci fix themselves to the leaf, or branch, for life. A light-colored, semi-transparent film, or case, with two projecting points at the narrow end, is soon formed over the young insect, and under this thin scale, it may at first be plainly perceived. The scale gradually increases in size, and becomes more opaque and brown, until the shell of the female attains its full growth, at which time it measures about the tenth of an inch in length. If the large scales are taken from the leaf, the female larva, or worm, may be seen in the concavity of the scale, in the same manner as an oyster or muscle, rather in the concave valve of its shell. This grub is of a yellowish, or sometimes pink color. The case itself, when turned upside down, appears to have a narrow margin of a whitish, or semi-transparent substance, where it had adhered to the leaf; a flat flap, or wing, extends on each side from the head, or narrowest end, at least two-thirds down the shell. This appears also to have adhered to the leaf. A longitudinal opening is left between the two projecting pieces, where the naked body of the grub may be seen. The end, towards the thicker extremity, is often vacant until filled with eggs, which, in color, are yellowish or pink. The head of the grub is placed towards the narrow part of the scale, and a piercer, or thread-like filament, proceeds from the under part of the breast, by means of which it sucks the juices from the plant. If the scale is gently removed from the leaf, it will often be found to hang to it by means of this thread-like piercer.

When the female commences to lay her eggs, under the shelter of the scale, they appear to be deposited in parallel rows on each side; but it is difficult to ascertain their number correctly. As many as twenty or thirty, however, have been counted in one female scale. The female decreases in size in proportion to the number of eggs laid, and finally, after having deposited all under the scale, she dies and dries away in the smaller end, with the case still adhering to the leaf. The scale of the male is much smaller than that of the female. The grub inside, after changing into a pupa, of a yellow color, with rudiments of wings, legs, and antennæ, eventually emerges from the case a perfect two-winged fly, so extremely minute as to be scarcely perceptible to the naked eye.

The head of the perfect fly is small, rounded, and furnished with two comparatively long, jointed, and somewhat hairy or bristly antennæ; the thorax is very large; it has six short legs, and two large, transparent wings, in which are two nervure. The body is short, in comparison with the thorax, and has a long point, curved down-

wards at the extremity of the abdomen, which is somewhat hairy. It is said of some of the coccus tribe that the males escape backwards from the shell, or case, with the wings extended flatly over the head.

Mr. Browne, in his work on the "Trees of America," states that "this insect first made its appearance in Florida, in Robinson's Grove, at Mandarin, on the St. John's, in 1838, on some trees of the Mandarin orange, which had been procured in New York. In the course of three or four years, they spread to the neighboring plantations, to the distance of ten miles, and were the most rapid in their migrations in the direction of the prevailing winds, which evidently aided them in their movements. In 1840, Mr. P. S. Smith, of St. Augustine, obtained some orange trees from Mandarin, and had them planted in his front yard. From these trees, the insects went to others in the same enclosure, and rapidly extended themselves to the trees and plantations to the northerly and westerly parts of that city and its vicinity, obviously aided in their migration by the south-east trade-winds, which blow there almost daily during summer; and, what is remarkable, these insects were occupied nearly three years in reaching trees in the south-east side of the city, only about half a mile from their original point of attack. They have since, however, extended themselves to all the trees in and about the city, but have not yet travelled in any direction beyond ten miles. Being aided in their dispersion by birds, and other natural causes, impossible to guard against, they must eventually attack most if not all the trees in Florida; for the wild-orange groves suffer equally with those which have been cultivated, and no difference can be perceived in their ravages between old and young trees, nor between vigorous and decayed ones. Various remedies have been tried to arrest their progress, such as fumigating the trees with tobacco-smoke, covering them with soap, lime, potash, sulphur, shellac, glue, and other viscid and tenacious substances, mixed with clay, quick-lime, salt, etc.; but all have failed, partially or entirely, and it appears not to be in the power of man to prevent the ravages of these insignificant and insidious destroyers."

The above remarks were first published in 1846, and at the present time, (1855,) the disease appears to have spread over the greater part of Florida, as was anticipated. Several other remedies have been proposed, one of which was earnestly recommended the past season. This consisted of a wash, composed of a gallon of water, a gallon of whiskey, and four ounces of aloes. Many contradictory reports as to the efficacy of this mixture have been received, some stating that it completely succeeded, while others contend that it was an entire failure, or merely destroying the first brood of insects already on the tree. If the latter should be the case, it might perhaps prove more effectual if the tree were well washed and syringed, every two or three weeks, as long as no perfect eggs remained upon the dried-up skin or shells of the dead female, to produce new generations, as, perhaps, these eggs might not be affected by the wash which was strong enough to destroy the life of the perfect insect. It would also be advisable to syringe the trees from time to time, even when very few insects can

be discovered on the branches or leaves, as the young cocci are so minute as to be almost invisible to the naked eye.

The plan of highly cultivating and enriching the soil has also been much recommended, as promoting a healthy, vigorous growth, and strengthening the constitution of the tree, so that it is better enabled to withstand the attacks of these foes. Grease from fat bacon, rubbed on the trunk and main branches, or the rind or outside thick skin, placed in the fork of the branches, where the fat and salt may run down the main stem, is said by one person to have been of much benefit; but others, who tried this plan, assert that the trees were killed in consequence of the application. In fact, so many different remedies have been recommended, and so many contradictory reports given of the results, that it will not be prudent to place reliance upon any of them, until a regular series of experiments shall have been instituted with the various mixtures, upon trees of the same age and strength, in different soils and localities, and a faithful report given as to the success or failure—bearing always in mind, however, that although the old scale insect may be destroyed, yet millions of eggs may remain unhatched under the sheltering scales, waiting only for a few days' genial sunshine to hatch and spread over the tree, which, perhaps, may have been washed in the meantime by heavy rains, so as not to leave a vestige of the mixture remaining to prevent the young from fixing themselves, *ad libitum*, when they first emerge from the sheltering scale.

Another kind of scale insect (coccus) is also found upon the orange-trees, which measures about the tenth of an inch when fully grown, and is of a much more oval form than that already described. The young cocci were of a yellowish-white color, and had the head and thorax somewhat defined by indentations on the sides, and marks on the scale itself. They are furnished with two antennæ, and had six legs, by means of which they moved about the leaf until they found a place suited to their taste, when they immediately fixed their piercers in a leaf or branch, and became coated with a scale-like covering, which appeared to adhere to the surface of the place where it was fixed; and here they remained motionless the remainder of their lives.

This description applies to the female coccus alone, as the males were not discovered; but doubtless they resemble the species already described, in being provided with wings, as well as in general habits. As the female scale becomes older, it gradually assumes a brownish-black appearance, having a somewhat lighter colored margin. This coccus appears to be peculiarly subject to the attacks of parasitical insects, which serve materially to check its increase. Many of the scales were observed in September to be punctured with small holes in their backs, made no doubt by small parasitical flies, which had devoured the original tenant of the scale. One of the flies which came out of these scales measured about the twentieth of an inch in length; the body and thorax were of a metallic green color; the eyes black, and the legs of a brownish color; the four wings were transparent, and the antennæ jointed and hairy.

Another hymenopterous fly came out of the dead scales, which also measured about the twentieth part of an inch in length, the thorax and first segment of the body being light-brown, with the rest of the abdomen blackish and hairy; the head was furnished with three ocelli; the four wings were transparent, and the antennæ long, jointed, and hairy. These parasitical flies no doubt do much good in lessening the numbers of this kind of coccus; as, although breeding in similar situations, and with apparently as good a chance to multiply as the others, it was not found to be nearly so numerous as the scale insect first mentioned. This may perhaps be attributed to the attacks of these flies, as hundreds of dried-up scales were seen with large holes in their backs, and the contents eaten out as above described.

While on the subject of the orange-scale insect, it may be as well to mention that some time last year (1855) another coccus was imported into Jacksonville, Florida, on some lemons sent from Bermuda; and, as they may perhaps spread in the vicinity, it would be well to draw attention to the insect, and describe it as far as known. The length of the full-grown female scale is rather more than the twentieth of an inch; it is somewhat pear-shaped, and of a brown color; the grub is of a reddish-yellow, and furnished with a piercer from its breast, like the coccus first described; the young have two antennæ, six legs, and two long hairs, or bristles, at the end of the body. The male scale is not so large as the female, and is formed of a white, cottony or parchment-looking substance, constituting a case, with an elevated and rounded ridge in the centre, in which a reddish pupa was found. The mouth of this case was stopped up with a dark-looking substance, apparently the cast-skin of the larva. The male larva is reddish in color, and measures not more than the fortieth of an inch in length. The perfect fly is also red, and is furnished with two hairy antennæ, six legs, and has the thorax very large. The two wings are transparent, and the end of the body is furnished with a curved, hard projection. As it is very probable that this insect will increase, it would be well to note any progress it may make during the ensuing year, and to use the remedies suggested in the first article on the coccus of the orange.

There are also found on the orange-trees numbers of small mites, which have frequently been mistaken for the young cocci; but they may be very easily distinguished, by their activity from the young scale insects, which crawl about very slowly. The mites have eight hairy legs, somewhat like those of minute spiders, and are mostly of a yellowish color, although some are also found of a delicate pink hue. They are generally seen briskly running among the stationary cocci, and may often be found concealed under the old scales; but, whether they do any harm to the tree, or merely feed upon the dead or dying cocci, has not yet been satisfactorily ascertained.

The pupa of a parasitical fly was found under the scale of one of the cocci; the head, wings, antennæ, and legs were perfectly formed as in the ichneumon-flies; the eyes were comparatively large and brown, and the rest of the body of a whitish-yellow. The perfect fly could not be recognised, however, as the pupa died without changing.

BEES, WAX, AND HONEY.

BEE-CULTURE IN RUSSIA.

The rearing of bees is extensively carried on in the several parts of European Russia, particularly in the central and southern governments, as well as in the Polish and in the trans-Caucasian provinces. This insect acclimatises up to a very high latitude, even in Siberia. It was long thought that the climate of the latter country was utterly unsuitable for the rearing of bees; but experiments made at the commencement of the present century in the governments of Tomsk, Omsk, and Jenisseisk have proved the contrary. It has greatly suffered, however, in some provinces, from the destruction of the forests; for the bee prefers well wooded districts, where it is protected from the wind. The honey procured from the linden tree (*Tilia europæa*) is only obtained at the little town of Kowno, on the river Niemen, in Lithuania, which is surrounded by an extensive forest of these trees, and where the rearing occupies the principal attention of the inhabitants. The Jews of Poland furnish a close imitation of this honey, by bleaching the common kinds in the open air during frosty weather.

The ceremonies of the Greek church, requiring a large consumption of wax candles, greatly favor this branch of rural economy in Russia, and preserve it from the decline to which it is exposed in other countries, from the increasing use of stearine, oil, gas, and other fluids for illuminating purposes. The peasants produce wax so cheaply that, notwithstanding the consumption of this article has greatly diminished abroad, it still continues to form an important item of the commerce of the country; but the exportation of honey has considerably increased in consequence of the extended use of potato syrup, which has also injured the honey trade in the interior.

The rearing of bees is now almost exclusively dependent on the manufacture of candles for religious ceremonies, and on the consumption of honey during Lent, it being then used instead of sugar, by the strict observers of the fasts. The government encourages this branch of rural industry, as affording to the peasant an extra source of income, and has adopted various measures for the accomplishment of this end. With the view of diffusing the requisite knowledge among the people of the public domains, bee-hives, and a course of practical instruction upon the subject of bee-culture, have been established at several of the crown farms, and pupils are sent every year, at the expense of the government, to the special school in Tschernigow, founded for the purpose, in 1828. After having finished their studies, the pupils, quitting this establishment, may become teachers in the schools dependent on the Ministry of Domains, or carry on the business of teaching on their own account. They enjoy a temporary exemption from military service; and such of them as wish to establish hives for themselves obtain loans for the purpose from the Department of Rural Economy. By way of further encouragement, the

Ministry of Domains has granted permission to the peasants to establish hives in the crown forests, under the precautions necessary to prevent the occurrence of conflagrations.

The total production of wax in Russia is estimated at 5,412,000 pounds per annum; and, as the usual calculation is three pounds of honey to one of wax, this supposes a production of 16,236,000 pounds of honey, the whole being valved at $2,250,000. D. J. B.

CONDENSED CORRESPONDENCE.

Statement of HENRY EDDY, *of North Bridgewater, Plymouth county, Massachusetts.*

I have had much experience in the production of "artificial colonies," and also in what is termed the "non-swarming" system of bees. But I have abandoned both, and am satisfied that the bees know the best time and mode of conducting their colonisation. I do not feed my bees with the expectation of obtaining thereby surplus honey for market; for no one receives back the amount he thus feeds, and what he does receive, is not much changed nor improved. I adopt the natural system of swarming, destroy no bees, but keep them alive and at work; and, if I have any advantage over others, it consists in placing them in circumstances under which full scope is given to their instincts. My profits from bee culture seldom fail from the loss of colonies in winter, or by depredations of the bee-moth at other seasons. By the mode I pursue, certain swarms are made to pay, in the increase of stock and honey, a profit of 100 per cent., while others give from 500 to 600 per cent. The average profit upon my entire stock, for several years, has been 327 per cent. per annum. I accomplish this by the use of a hive of my own construction.

My surplus honey sells readily in market for 25 cents a pound.

IMPROVEMENT OF LAND.

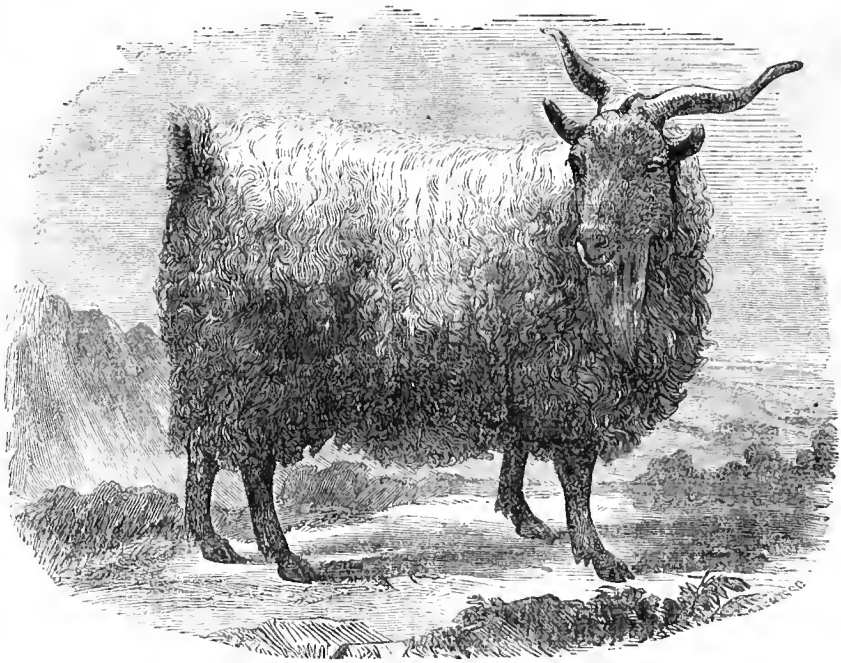
ON THE DRAINAGE OF HAARLEM LAKE, WITH SUGGESTIONS ON ITS APPLICABILITY TO OVERFLOWED LANDS IN THE UNITED STATES.

Thrift and plenty are the ideas we ever associate with the name of the Netherlands. Placed in a situation in which the exercise of industry, perseverance, prudence, and economy is essential to their very existence, the people of the "Low Countries" cheerfully obey the beneficient command to labor; and such are the fruits of their willingness to toil, that the rest of the world behold them with wonder and admiration.

From the middle of Belgium, a few miles north of Brussels, the country north-eastwardly becomes almost entirely a dead level, extending in monotonous sandy and peaty flats through Hanover, Jutland, Holstein, and, with little interruption, through Prussia into Russia. But the lowest part of this immense region, and that which has most recently emerged from the sea, is undoubtedly the country lying between the mouths of the Scheldt and the Ems; within this distance the Rhine, joined by the Meuse, Yssel, and other rivers, enters the sea, through a number of arms, and sluggish winding channels, which by no means represent the magnitude of their main streams as they appear higher up. The delta of the Rhine may be conceived to have been in early ages subject to perpetual changes of form, as new mud-banks were deposited, blocking up the old channels, and leading to the formation of new ones. Besides, it is obvious that the river, in forming a domain of alluvial deposits had to contend with the sea, which washed away the accumulations of mud, or covered them with sand, according to the vicissitudes of the seasons. The soil of the Netherlands shows everywhere the proofs of this struggle between the billows of the ocean and the river floods, in the alternation of salt and fresh water deposits. It also bears evidence to the fact, that these changes, effected by the inundations of the Rhine, or by encroachments of the sea, occurred frequently, long after the country had become inhabited. Remains of forests now lie buried under the waves of the German ocean; paved roads and traces of villages and of cultivation are found beneath the morasses on the banks of the Ems, and many similar proofs exist of great physical changes, respecting which history is silent.

For the purpose of securing the permanence of their territorial possessions, the early occupants of this country had recourse to dikes, or embankments, high and strong enough to protect them under ordinary circumstances from the tides; and, placing wind-mills on these

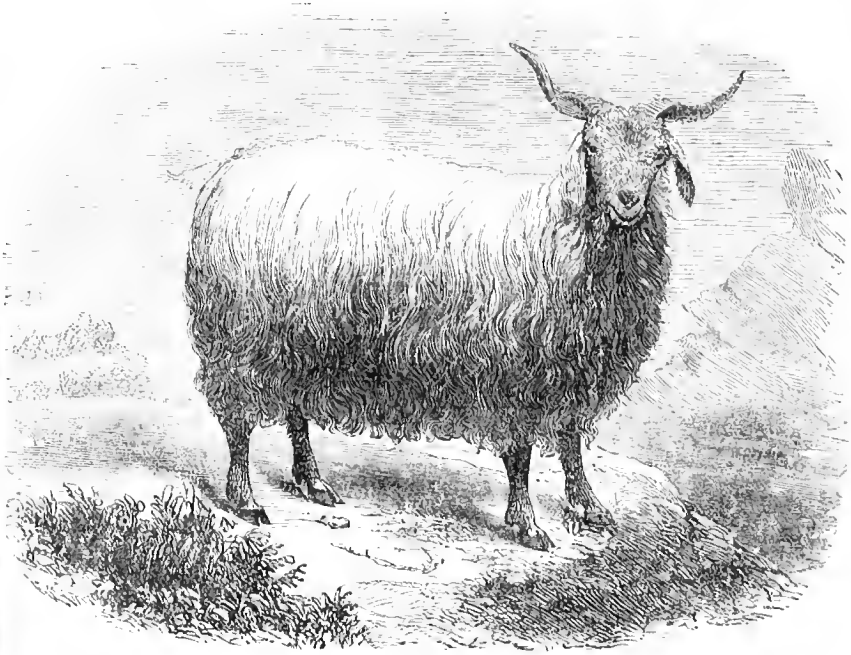
Pl. IV.



MALE CASHMERE GOAT.

The property of Richard Peters, of Atlanta, Georgia, imported in 1849 from Turkey, in Asia, by J. B. Davis, M.D., of South Carolina. Live weight 155 pounds. Weight of yearly fleece 7 pounds.

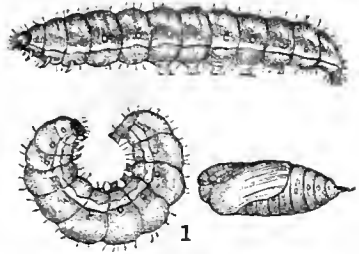
Pl. V.

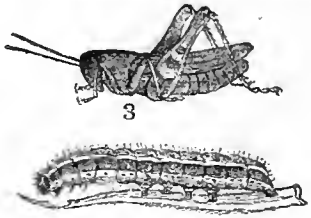


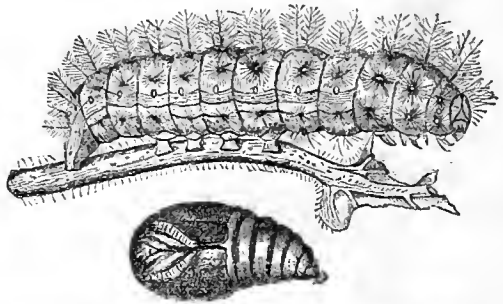
FEMALE CASHMERE GOAT.

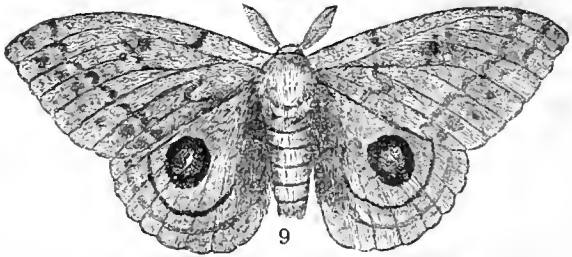
The property of Richard Peters, of Atlanta, Georgia, imported in 1849 from Turkey, in Asia, by J. B. Davis, M.D., of South Carolina. Live weight 102 pounds. Weight of yearly fleece 4 1-4 pounds.

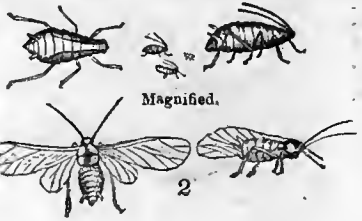
Pl. VI.

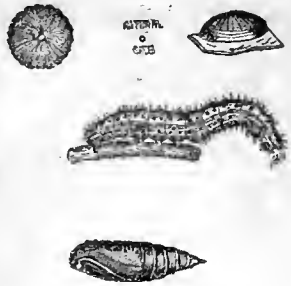


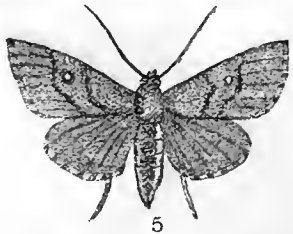










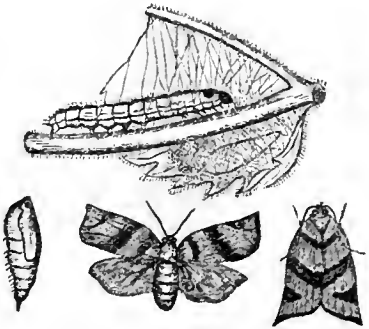


4

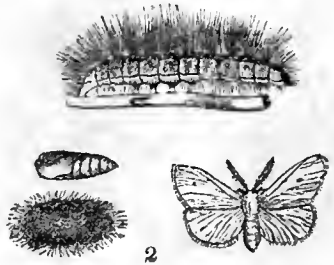
6

7

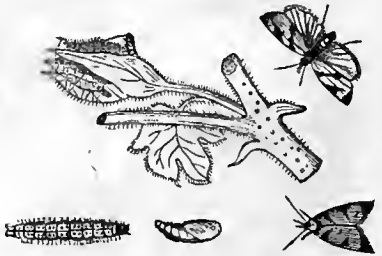
5



1



2



3

8

10

11

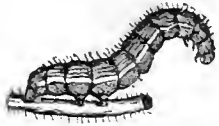
9

1

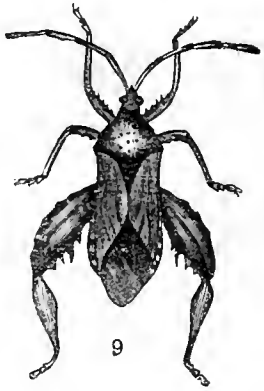
5

6

3



7



9

8

2

10

11

4

6

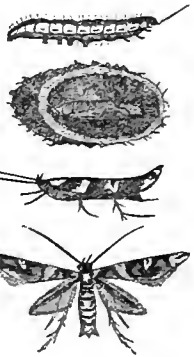
Natural size.

9

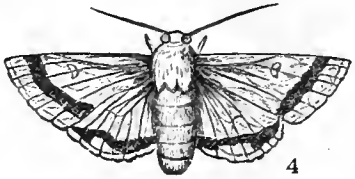
Magnified.

1

Magnified.



3

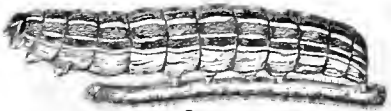


4

7

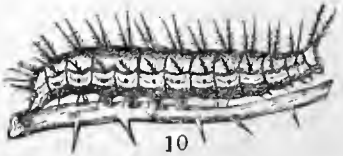
Magnified.

2

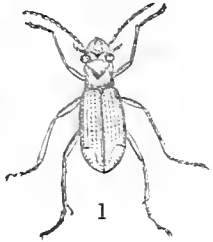


5

8



10

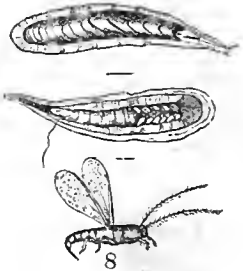


1

5

7

Magnified.



8

4

Magnified.

6

3

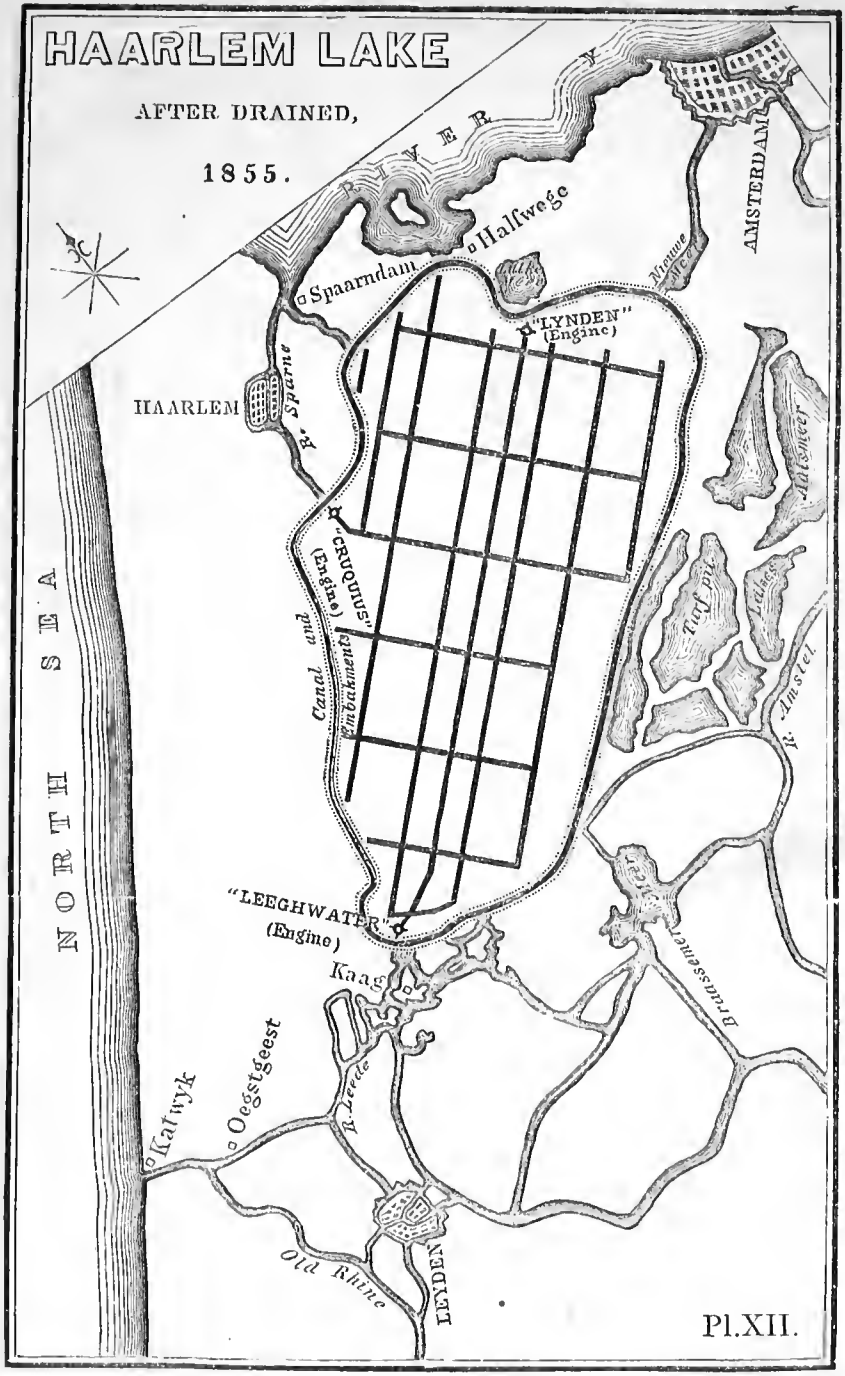
2

HAARLEM LAKE

BEFORE DRAINED

1843

Pl.XI.


HAARLEM LAKE
AFTER DRAINED,
1855.
RIVER Y
AMSTERDAM
Halfwege
Spaarndam
Nieuwe Meer
"LYNDEN" (Engine)
HAARLEM
R. Spaarne
"CRUQUIUS" (Engine)
Canal and Embankment
Turf pits
Lakes
Aalsmeer
R. Amstel
"LEEGHWATER" (Engine)
Kaag
Drassemeer
R. Aarde
Katwyk
Oegstgeest
Old Rhine
LEYDEN
NORTH SEA
Pl.XII.